“CERVICAL DEGENERATIVE DISEASE– CLINICAL PRESENTATION, RADIOLOGICAL CORRELATION, SURGICAL OPTIONS AND OUTCOME”

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CERTIFICATE

This is to certify that the dissertation entitled **"CERVICAL DEGENERATIVE DISEASE– CLINICAL PRESENTATION, RADIOLOGICAL CORRELATION, SURGICAL OPTIONS AND OUTCOME"** is the bonafide original work of **DR.S.S.ARAVIND** in partial fulfillment of the requirements for Branch II, M.Ch Neurosurgery, examination of THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY to be held in August 2013. The period of post – graduate study and training was from May 2008 to August 2013.

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DECLARATION

I solemnly declare that the dissertation titled **"CERVICAL DEGENERATIVE DISEASE– CLINICAL PRESENTATION, RADIOLOGICAL CORRELATION, SURGICAL OPTIONS AND OUTCOME"** is done by me at Government Stanley Medical College, during 2008- 2013 under the guidance and supervision of **Professor Ranganathan Jothi,** M.Ch., Neurosurgery.

The dissertation is submitted to The Tamilnadu Dr.M.G.R. Medical University towards the partial fulfillment of requirements for the award of **M.Ch Degree in neurosurgery.**

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CONTENTS

INTRODUCTION

INTRODUCTION

Cervical disc disease may be more neurologically compromising due to anatomic particularities than the more frequently occurring lumbar disc disease. However, cervical degenerative disc disease is the most common cause of acquired disability in patients over the age of 50.

In 1543, the anatomist Andreas Vesalius (1514- 1564) was the first to describe the intervertebral disc. But its role in the development and cause for various clinical signs and symptoms was recognized only about 90 years ago. In 1938 STOOKEY reported on clinical syndromes produced by herniated cervical discs. He proposed the prolapse to be "chondroma of the notochord." Investigations by Schmorl in Europe and Keyes and Compere in the United States described pathophysiology of intervertebral disc. Mixter and Barr proposed the association between lumbar disc prolapse with clinical features of root compression. The pathogenesis of the cervical intervertebral discs was identified as the reason for neck pain, myelopathy and radiculopathy.

In early stages the only surgical approach for symptoms produced by cervical disc was posterior. In the second half of the 19th century, it became evident that the main problem of posterior approach was the technically challenging aspect of removing compressive elements that lie anterior to the spinal cord and nerve roots. Thus the need for better access to reach anteriorly placed compressive elements led to the anterior approach to the cervical spine. In 1952, Bailey and Badgley displayed the first anterior stabilization of the cervical spine and published their results in 1960. In 1955, Smith and robinson demonstrated their method to stabilize a

pathologically cervical spine segment using a iliac bone graft. In 1958, Cloward described his unique technique of anterior discectomy to remove the compressive elements.

As age increases the cervical spine undergoes degeneration and causes axial pain with varying spectrum of radiculopathy and myelopathy depending on the severity of cervical stenosis.

The present study is a prospective study of 80 patients who were treated for cervical spondylosis who were treated during the period of 2009- 2013. This includes patients who were treated conservatively.

AIM
&
OBJECTIVES

AIMS AND OBJECTIVES

1. To assess the age and sex incidence, nature of pain, presence or absence of myelopathy, motor/sensory/deep tendon reflex disturbance in case of cervical degenerative disease.

2. To measure TORG-PAVLOV ratio using C – spine lateral image and the anterio-posterior diameter of the spinal canal using MRI C spine.

3. To correlate with clinical findings and outcomes of various modalities of treatment and outcome of surgery.

4. To assess the pre operative and post operative X ray with regards to the progress of spondylosis.

5. To evaluate the clinical improvement in radiculopathy, myelopathy, neurological deficit in follow up of patients upto 4 – 6 months.

6. To assess the pre operative and post operative nurick's score.

7. To assess the pre op and post op pain score [WONG- BAKER pain score].

8. To assess the outcome of conservative treatment.

MATERIALS
&
METHODS

MATERIALS AND METHODS

SOURCE OF DATA

This is a randomized study of 80 patients of cervical spondylosis of age between 20 – 80 years which was carried out in the department of neurosurgery during the year 2009-2013 at GOVT STANLEY MEDICAL COLLEGE, CHENNAI.

METHODS OF COLLECTION

A Standardized protocol is followed for assessment of patients after an informed consent.

Clinically patient had axial and subaxial neck pain as their predominant complaint. Sensory symptoms precede the motor symptoms in majority of the patients. Complete neurological examination to ascertain the motor/ sensory loss and loss/ brisk reflexes and any signs of myelopathy.

There is some amount of neck movement restriction as the pain progresses because of the neck muscle spasm. Impairment of the deep tendon reflexes is seen in most cases of radiculopathy - most common being brachioradialis. Sensory changes is seen predominantly in the C6 and C7 dermatome. Radiculopathy pain is aggravated by coughing, sneezing and lifting heavy weights.

Careful history and examination is done to rule out shoulder pathology, angina and intraspinal tumors.

All patients clinically suspected to be suffering from cervical spondylosis are subjected to radiological imaging. Digital X ray C spine is taken to measure PAVLOV- TORG ratio and assess the degree of cervical stenosis. Evidence of cervical spondylosis in imaging is assessed by presence of

1. Anterior osteophytes
2. Disc space narrowing
3. Loss of lordosis
4. Foraminal spurs.

MRI C SPINE with myelogram is done for all the patients with cervical spondylosis. MRI is done to assess the degree of root or cord compression, measure the spinal canal, disc herniation,osteophyte protrusion into the canal, ligamentum flavum hypertrophy and ossification of posterior longitudinal ligament.

CT C SPINE is done only in patients suspected to have Ossification of Posterior Longitudinal Ligament in the MRI. CT is not routinely done as MRI being the investigation of choice.

STUDY DESIGN

Cohort Study

INCLUSION CRITERIA

1. Age 20-80 yrs
2. Sex : male & female

3. Patient presenting with neck pain { no neurological deficit } with no MR findings of root or cord compression were included in the group managed conservatively after ruling out other pathological causes of neck pain.

4. Patients with radiculopathy with MR evidence of root compression with root compression signs such as motor/ sensory / deep tendon reflexes changes.

5. Patients presenting with compressive form of myelopathy with MR evidence of cord compression.

EXCLUSION CRITERIA

1. Post traumatic radiculopathy{ acute history of symptoms and signs}

2. Post traumatic myelopathy/ post traumatic subluxation. { with no history of cervical spondylosis}.

3. Congenital disorders like klippel fiel syndrome.

4. Spinal tumours.

5. Miscellaneous conditions like spinal epidural hematoma/abcess.

TREATMENT OF CASES IN THIS STUDY

NON OPERATIVE / CONSERVATIVE MANAGEMENT

All patients with clinical suspicion and radiological evidence of cervical spondylosis with no neurological deficit are subjected to conservative line of

management. These patients are reviewed periodically to assess appearance of any new neurological deficits and the response to conservative treatment.

In absence of acute focal neurological deficit or development of myelopathy all patients are treated with a trial of non operative conservative line of treatment.

CONSERVATIVE TREATMENT

MEDICATIONS

MECHANISM OF ACTION

1.	NSAID	:	decreases inflammation / pain relief
2.	Acetaminophen	:	pain relief
3.	Oral steroids	:	reduce inflammation / reduce radicular Symptoms
4.	Muscle relaxants	:	obviate paravertebral muscle spasm.
5.	Narcotics	:	not routinely used / decrease acute severe pain
6.	Tricyclic anti depressants:		decrease radicular symptoms by altering the perception of pain.
7.	Anti convulsants	:	reduces pain and radicular symptoms.

PHYSICAL THERAPY / LIFE STYLE MODIFICATION :

1. Advice weight loss.
2. Avoidance of precipitating factors.
3. Muscle stretching and strengthening exercises after subsidence of acute pain.

4. Avoid lifting heavy weights and strenuous activities.

5. Heat application to decrease pain.

OPERATIVE TREATMENT

All patients with clinically root and cord compression are operated without any delay as bladder / bowel symptoms once set will take a longer time to recover. Compressive myelopathy needs more urgent surgery than a radiculopathy.

The main goal of operative treatment in cervical spondylosis is to de-compress the affected neural elements be it the root or the cord. The majority of the patients presenting with radiculopathy with MR evidence of root compression underwent anterior cervical discectomy with iliac bone graft without fixation. Patients who underwent multi- level anterior cervical discectomy with iliac bone grafting were stabilized with cervical spine locking plates.

Patients with myelopathy with the offending pathology anteriorly underwent anterior cervical discectomy or corpectomy. Patients with multi level OPLL and ligamentum flavum hypertrophy underwent posterior cervical decompressive laminectomy without fixation.

REVIEW
OF
LITERATURE

REVIEW OF LITERATURE

1. RELEVANT ANATOMY

Cervical spine, the design in itself allows a wide range of motion - flexion, extension and lateral bending. It is composed of seven vertebra arranged one on top of another, spinal ligaments and spinal cord segments which run within the spinal canal. Approximately 50% of flexion and extension of the neck occurs at the occiput-c1 level, and 50 % of axial rotation occurs between C1 and C2.

Between adjacent vertebra lies the the intervertebral disc made up of peripheral annulus fibrosus and central nucleus pulposus. Ultrastructure of the disc is similar to that in the thoracic and lumbar spine. But one difference between them is that, at the lateral margins of the cervical disc space is a bony process seen above the concave superior end plate of the vertebral body - UNCUS. The articulation between the vertebral body and uncus in the cephalad aspect is known as the uncovertebral joints of LUSCHKA. The cervical disc are taller anteriorly which contributes to the normal cervical lardosis of 20 to 40 degrees.The transverse process seen in the dorsal and lumbar spine are modified in the cervical region to form the lateral masses. Synovial joints connecting adjacent cervical vertebra posterolaterally are the facet joints.

Pedicles of the cervical spine are short and arise from the posterior vertebral body and converge posteromedially into the lamina and converge posterolaterally into the lateral masses. The superior and inferior articular surface of the lateral masses constitute the facet joint which is a true synovial joint surrounded by a capsule with synovial fluid. The facet joints are oriented 45 degrees to the frontal plane and are flat. Neuroforamen is a zone where the corresponding nerve roots exit.

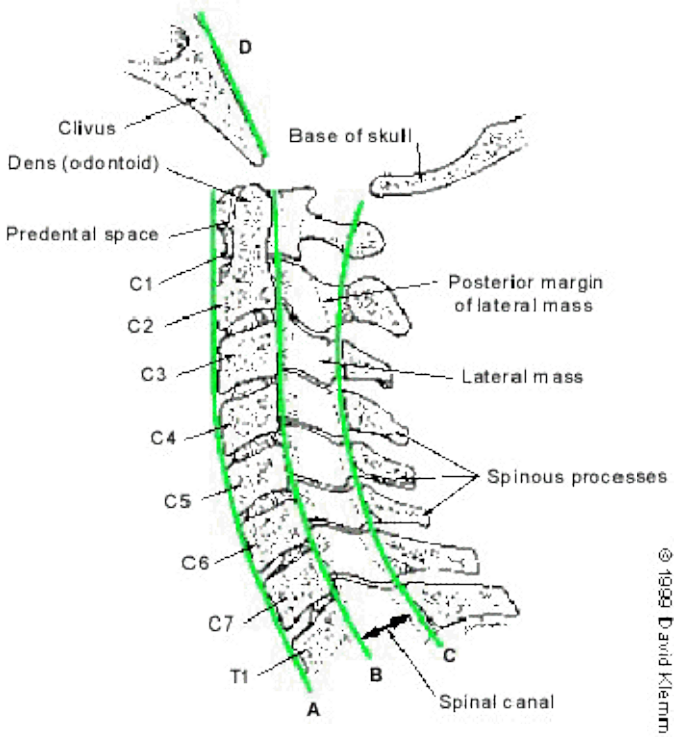
This foramina is bounded superiorly and inferiorly by the pedicles, posteriorly by the lateral masses, anteriorly by the disc and posteriorly uncovertebral joint.

Spinal ligaments include the anterior and posterior longitudinal ligaments, which are continuous bands that run along the anterior and posterior vertebral bodies. The ligamentum flavum is a thick band that attaches between the lamina of each vertebra. The interspinous ligament attaches two adjacent spine.

At the leval of C1 the cord occupies one half of the canal and at the level of C5-C7 cord occupies three quarters of the canal. This explains why spondylotic myelopathy is common in this region.

Vascular supply of the cord is mainly by the 2 small dorsolateral arteries and a large anterior spinal artery, the latter which supplies 60 – 75 % of the cord blood flow.

RADIOGRAPHIC ANATOMY OF THE CERVICAL SPINE



The atlas and the axis are unique shaped to assist greater degree of motion to the head. They are responsible for most of the movement of the head and neck. The third to the seventh cervical vertebra are called the typical cervical vertebra and have similar structure.

The three dotted lines are

A – anterior interbody line

B – posterior interbody line.

C – spino laminar line.

CERVICAL SPONDYLOSIS–CERVICAL RADICULOPATHY AND CERVICAL MYELOPATHY

CERVICAL RADICULOPATHY

Cervical spondylosis is a degenerative disease of the cervical spine. It is a spectrum term which includes all degenerative diseases of the cervical spine. It includes cervical radiculopathy and myelopathy. Degenerative changes are noted in the facet joint, hypertrophy of the ligamentum flavum and ossification of posterior longitudinal ligaments, anterior and posterior osteophytes, bony spurs. All these can impinge on the pain sensitive structures and cause various clinical syndromes.

PATHOPHYSIOLOGY

Degenerative of the normal anatomy associated with nerve root impingement causes the clinical syndrome of cervical radiculopathy. The most common site of this impingement is the neuroforamina. Nerve roots exit through this narrow space, where it is susceptible to degenerative changes such as formation of osteophytes or disc herniations causing neuroforaminal stenosis. As the age increases biochemical alterations take place in the disc, resulting in dehydration and decrease in the number of chondrocytes. Changes in the proteoglycan to collagen and keratin sulphate to chondroitin sulfate concentrations. This results in the weakening of annular disc fibres and disc herniations with loss of height with disc dessication, leading to closer apposition of the intervertebral bodies, resulting in intervertebral and neuroforaminal stenosis.

Transmission of force onto the articular facet joints or at the uncinate processes causes altered biomechanics resulting in changes in cervical lordosis. As

the overall disc space collapses, the ligamentum flavum may buckle into the spinal canal, leading to central cervical canal stenosis.

Nerve root irritation may occur as intervertebral discal proteoglycans are degraded. Cervical nerve root exits above the corresponding vertebral body of the same number. Eg: typical neural foraminal lesion at C5-C6 level will commonly result in C6 radiculopathy.

FREQUENCY

It is less common than axial neck pain and occurs in 0.5 % to 3 % of individuals. The age of peak incidence is around 50 yrs. The radicular symptoms resolve in about half of the individuals on conservative therapy [Lees & Turner et al.].

SEX

It affects males earlier than females, The incidence in males is 58 % and female 42 %.[Liche et al.].

HISTORY

The various clinical symptoms manifest quiet differently.

Radicular symptoms in the upper extremity, shoulders, upper back and neck is the most common syndrome seen in clinical practice [Mccorneck et al.]. It is caused by dysfunction of the cervical nerve root, therefore symptoms are typically unilateral and follows a myotomal and dermatomal pattern associated with a nerve root.

Innervation of the intervertebral disc, posterior longitudinal ligament, periosteum, and pedicle by the sinovertebral nerve and the medial branches of the dorsal rami in the cervical region [Hellar et al.].

Acute disc herniations can compress the nerve root either at its exit from the spinal cord or within the foramen. Chronic disc herniations or bulges can calcify or contribute to the uncovertebral osteophytes, impinging the nerve root as it enters the neural foramen [hard disc pathology].

The occipital pain associated with cervical spondylosis is because of compression of C3 nerve root. The C6 and C 7 nerve roots are the most frequently affected roots. The pain is more frequent in the upper limb than in the neck [Ellenberg et al.].

99% of patients present with arm pain, 85% had sensory changes, 80% had neck pain, 71% had abnormal reflexes and 68 % had motor deficits. [Heckmann et al.].

PHYSICAL FINDINGS

Examination of the patient presenting with symptoms of cervical radiculopathy demands a detailed examination of the neck, shoulder, arm and lower extremities. Motor, sensory and reflex abnormalities localize the level of pathology.

Rotator cuff disorders, lateral epicondylitis and peripheral nerve entrapments can mimic symptoms of cervical radiculopathy and careful examination rules out these pathological conditions.

Specific physical examination maneuvers are used to evaluate cervical radiculopathy.

SPURLING'S sign – extending and rotating the head towards the involved side can worsen the radicular pain. It has a specificity of 93 % and sensitivity of 30%.

Flexing the neck tends to enlarge the foramen and relieves the pain, but if it's a central disc the pain tends to increase.

Rotating the head away from the affected side and abducting the shoulder tends to decrease the radicular pain – SHOULDER ABDUCTION TEST.

CAUSES

1. Age and sex.
2. Repeated occupational trauma.[carrying axial load, professional dancing, gymnasts].
3. Prolonged occupational posture [sitting in front of the compute for software prossionals].
4. Familial.
5. Smoking.
6. Abnormal neck posture. Eg: sleeping in seated posture, driving on a 2 wheeler for long hours.

INVESTIGATIONS

Plain x ray C spine:

1. Loss of cervical lordosis.
2. Decrease in disc space.
3. Anterior and posterior osteophytes.
4. Bony spurs.

Although CT scan will clearly delineate the cervical bony pathology they are of limited use in spondylosis and radiculopathy as the nerve root entrapment and the cord are seen only in an MRI C spine. MRI provides excellent visualization of the pathology and nerve root compression.

MANAGEMENT

NECK PAIN DUE TO CERVICAL SPONDYLOSIS

Pain usually resolves with conservative treatment with NSAID and pain killers. Soft collar has a role in acute pain, after the pain subsides patient should be started on simple mobilizing exercises under guidance of a physiotherapist. Life style modification and avoidance of risk factor can also be advocated.

SURGICAL TREATMENT

Anterior cervical discectomy through the anterior approach followed by autologous bone graft fusion with iliac bone is done.

If more than one cervical discectomy is planned stabilization with cervical spine locking plate is done.

Stabilization is not routinely done for single level anterior discectomy.

Most recent is to use cage or artificial disc after discectomy.

CERVICAL SPONDYLOTIC MYELOPATHY

Cervical spondylotic myelopathy is the most common type of dysfunction of the spinal cord in patients who are more than 55 years old. In 1952, BRAIN et al reported the first largest series of patients who had this disorder. This condition is still under recognized.

It is part of the clinical spectrum of the degenerative disorders of the spine. This spectrum includes neck pain syndromes, radiculopathy and myelopathy. However there appears considerable overlap in these clinical syndromes.

CSM is divided into 5 distinct syndromes based on the clinical presentation. All these syndromes are based on clinical signs and symptoms and MR evidence of cord compression.

CAPLAN and FERGUSON elucidated 4 of these syndromes.

1. Nerve root compressive symptoms [radicular pain and neurological deficit] are seen in radicular or lateral syndrome.

2. Long tract signs and symptoms are seen in medial or myelopathic syndrome.

3. Nerve root and long tract signs both are seen in combined syndrome.

4. The least common vascular syndrome results in variable vascular injury to the cord causing ischemia. This syndrome may not present with correlative motor or sensory pattern.

5. Recently, CSM is postulated to cause painless weakness in the upper limbs without any accompanying symptoms in the lower limbs. This has been postulated as the fifth syndrome – anterior syndrome.

Cause of the fifth syndrome has been postulated as pressure affecting only the anterior horns of the gray matter of the spinal cord [Abramovitz & Srinivasan et al.] and overstretching of the cord with neck flexion damaging the anterior horn cells at the level of disc bulge [Ohivada et al.].

CLINICAL SYMPTOMS AND DIAGNOSIS

Clinical spectrum range from clumsiness of hands with difficulty with fine motor skills [eg : buttoning and hand writing], diffuse non dermatomal upper extremity numbness usually the hands. Upper motor neuron signs like hyperreflexia, clonus, Babinski response. With particular movements of the neck the patient may have electric shock like sensation down the spine – LHERMITTE sign. Bladder and bowel disturbances occur rarely and late in the course of the disease and carry a poor prognosis.

UMN signs in the upper limb include Hoffmans, inverted brachioradialis reflex, rhombers sign.

The differential diagnosis include

1. Multiple sclerosis.
2. Transverse myelitis.
3. Cerebrovascular accidents.

4. Movement disorders.

5. Tumors of the spinal cord.

6. Syringomyelia.

7. Vascular injury to the spinal cord.

PATHOGENESIS

CSM is due to a combination of degenerative spondylotic changes to the cervical spine. The following pathologic mechanisms are implicated in the course of cervical spondylosis to cervical spondylotic myelopathy.

1. Static mechanical.

2. Dynamic –mechanical.

3. Ischemia of the spinal cord.

4. Injury associated with stretch.

1. STATIC MECHANICAL FACTORS

Cervical spondylosis causes formation of ventral osteophytes which narrows down the cervical cord. This explains why patients with congenitally narrow cervical spinal canals of size 10-13 mm are predisposed to CSM.

Hypertrophy of the ligamentum flavum and thickening of the bone pertaining to advancing age narrows the space available for the cord [Mccomiah et al.].

Subluxation and degenerative kyphosis are common and add to the cord compression [Emery et al.].

2. DYNAMIC FACTORS

Added to the static mechanical factors, flexion and extension of the neck causes dynamic compression of the cord. In flexion, the lengthened spinal cord stretches and hitches over the ventral osteophytic bars. On extension, the ligamentum flavum buckles into the spinal cord pinching the cord between the ligaments and the osteophytes anteriorly [Young et al.].

The narrowing of the canal along with the abnormal motion seen in CSM results in increased strain and shear forces, causing localized axonal injury to the cervical cord.

3. SPINAL CORD ISCHEMIA

Strain in the cord causes micro ischemic changes to the cord in CSM. Pathologically, the grey matter is predominantly involved with little involvement of the white matter. This pattern is coherent with ischemic insult. Ischemia of the cord occurs at the level of decreased microcirculation [Almifty et al.].

Compression of the cord circumferentially leads to intrinsic changes in the spinal cord. Pathological studies show a consistent pattern of degeneration of the lateral and posterior white matter tract, particularly the funiculus gracilis and corticospinal tracts. Gliosis and neuronophagia are noted in the anterior and posterior horns of grey matter. Dorsal nerve root atrophy and to a lesser degree the ventral nerve root atrophy are also noted. For reasons unknown anterior columns of the white matter are relatively spared.

PINCER phenomenon is seen in dynamic compression with normal or abnormal motion, causing varying degree of cord compression.

The micro neural changes in the cord due to mechanical/ ischemic insult are :

1. Blockage of axoplasmic flow.

2. Distortion of the tissue of the cord.

3. Stretching of the intrinsic transverse terminations of the anterior spinal artery.

Direct compression of the cord is not the only mechanism which causes myelopathy. Pressure induced neuro ischemia may be one of the contributing factor for myelopathy. Anterior spinal artery supplying about 65- 70 % of the cord is prone to compression by the spondylotic bars due to its mid- sagittal position. Thrombosis of the anterior spinal artery has not been conclusively demonstrated as the cause of myelopathy. However there is evidence to suggest that there is interruptions of the sulcal and terminal vessels of the anterior spinal artery due to direct compression.

DIAGNOSTIC IMAGING

Radiographs of the cervical spine in anterioposterior and lateral images with the spine in flexion and extension can show osteophytes, disc space, spondylolisthesis and the instability. The sagittal diameter of the cervical spinal canal on lateral images can be used to assess the degree of the cervical stenosis. Cervical stenosis, the value for critical stenosis is varied from study to study because of varying magnification of projected images. This magnification error can be obviated by using PAVLOV 'S ratio which is the ratio between the anterioposterior diameter of the canal divided by the anterioposterior diameter of the vertebral body. The

normal value is one. a value of 0.8 suggests that the canal is developmentally stenosed.

Magnetic Resonance Imaging is the investigation ideally suited for cervical myelopathy. It has better resolution to visualize the cord and the cervical canal with its supporting ligaments. The root and the disc are better visualized with the MRI. CT scores over the MRI in analyzing bony details. It is correlated that with a 30 % reduction in the area of the spinal cord causes myelopathy.

ELECTROPHYSIOLOGICAL STUDIES

All patients with CSM have abnormalities in the motor and somatosensory evoked potentials.

The H reflex [electrophysiological response of tibial nerve] is present in the upper extremities of normal adults rarely. But it has been consistently seen in most patients who have cervical myelopathy. So it may be advisable to monitor objectively the progress of the compression of the cord and the nerve roots with electrophysiological studies.

Currently, the recording of a thorough history and the clinical neurological examination are probably the reliable method of follow up of such patients.

NATURAL HISTORY

There are very few studies that have successfully addressed the natural history of compressive myelopathy.

LaRocca proposed that there's no conclusive evidence available for the surgeons to predict whom the operative treatment is absolutely indicated. The spectrum of clinical syndromes range from minimal neurological deficit present for a long duration of time to acute catastrophic deterioration over a matter of few days of time.

There is no predictive factors which predict which patient will have acute deterioration. Deterioration can be rapid and devastating and result in sever disability. In such patients it is generally agreed upon that these set of patients will remain severely disabled and their condition continues to worsen.

The degree of post operative outcome is not predictable. Prevention of further deterioration is a clear indication in early surgery. So the best outcome is seen in patients with early operative intervention before major irreversible neurological damage has occurred.

NON OPERATIVE MANAGEMENT

There is no role for patients with cervical spondylotic myelopathy to be managed conservatively. In certain rare scenarios in extreme of age with multiple co morbid medical conditions where a major surgery is out of question, such patients can be managed conservatively with firm neck immobilization, bed rest, NSAID s and muscle relaxants and physical therapy.

OPERATIVE TREATMENT

The single most important indication for surgical intervention is progressive neurological deterioration.Iirreversible changes occur in spinal cord on prolonged

compression of the cervical cord. Thus early surgical treatment is warranted just when the patient presents with early myelopathy.

ANTERIOR APPROACH

Anterior approach to the cervical spine was pioneered in the early 1950s by BADGLEY and BAILEY, SMITH and ROBINSON and CLOWARD. The approach is recommended when the myelopathy is caused by cord compression in the anterior aspect of the cervical spine. The term level is defined as the disc and the adjacent vertebra. In a typical anterior cervical discectomy the offending disc, anterior and posterior osteophytes, posterior longitudinal ligament and medial portions of the uncovertebral joint are removed. The empty space created after the removal of the disc is replaced by

1. Autologous dowel fitted bone graft.

2. tricorticate iliac bone graft.

3. metallic cage.

4. artificial disc material.

Cervical corpectomy is the direct decompression of the compromised cord in a kyphotic spine where an indirect posterior decompression is contraindicated.

POSTERIOR APPROACH

Approach to the cervical spine posteriorly is primarily to decompress the spinal cord. Posterior approaches were the main stay of treatment until 1950s when anterior approaches were pioneered.

Advised in patients with compressive elements present posteriorly and in patients with multiple level compressive elements. Decompression involves extensive laminectomies of the third to sixth cervical vertebra, also with specific nerve root decompression by appropriate foraminotomies when there is radiculopathy and patients with failed anterior approaches.Orthosis of the cervical spine is not necessary except for control of pain and musce spasm. After extensive laminectomies all patients are subjected to intense rehabilitation program which includes physical therapy, isometric muscle strengthening exercises to strengthen the paraspinal muscles. These exercises are necessary to avoid post operative complications of disability and possible swan neck deformity.

The advantage of the posterior approach is the ability to decompress the nerves and the cord under direct visualization and avoid anteriorly placed major structures like the great vessels,esophagus and recurrent laryngeal nerve.

Recent trends are laminoplasty and laminectomy with fixation. Laminoplasty is lifting the posterior spinal elements en bloc on one hinge, thereby preserving the posterior osseous elements. Theoretically, laminoplasty can reduce the formation of post laminectomy membrane because of a protective covering over the spinal canal.

Loss of lordosis and kyphosis are contraindications for posterior decompression alone. If the kyphotic deformity is not corrected by cervical extension and fixation it is advisable to decompress anteriorly.

There appears no significant superiority of laminoplasty over the traditional decompressive laminectomy for treatment of cervical spondylotic myelopathy [Hukuda et al.].

LITERATURE ON TORGs RATIO

Magnification is one of the major deterrent in measuring the spinal canal diameter. This can be due to both the object to film and the focus to film distances [vertebra is the object in this case]. Focus to film distance can be fixed but the object to film distance is subjected to change which depends on the different shoulder breadths between individuals.

This confounding factor can be removed by using a ratio as proposed by PAVLOV.

$$\textbf{TORG'S RATIO} = \frac{\textbf{A}}{\textbf{B}}$$

But there has been various papers questioning the complexity in using X ray in measuring the spinal canal diameter. Controversies apart TORG – PAVLOV ratio seems to be the only possible means to measure the canal diameter to the closest.

Senol et al proposed that plain X ray lacked predictive value.

Blackley et al reported that measurements in plain X ray correlate poorly with canal diameters in computer tomography.

Robertson et al concluded that torg's ratio < 0.82 correlated with myelopathy.

LITERATURE ON SAGGITAL DIAMETER OF THE SPINAL CANAL IN MRI

Absolute cervical canal stenosis is defined as a canal measuring 10mm in AP dimension, whereas relative stenosis denotes 10-14 mm canal. Both radicular and myelopathic complaints arise when the canal is narrowed to these critical dimensions as the cord itself occupies between 0.8 and 1.3 cm in the anterior/posterior dimension, and soft tissues take up another 2–3 mm. 2 Disc herniations, spurs, Ossificiation of Posterior Longitudinal Ligament, and Ligamentum Flavum Hypertrophy further compromise the already narrowed space, increasing the likelihood of incurring a significant neurological deficit even with minor traumatic events especially extension.

BENOIST et al in 2002 graded the MR sagittal canal diameter into 4 grades

Severe stenosis < 10mm.

Moderate stenosis – 10 -12 mm.

Mild stenosis – 12-14 mm.

Normal > 14 mm.

We used this garding system in our study to analyse the antero-posterior spinal canal diameter in the MRI images.

LITERATURE ON SURGICAL OUTCOME

Nurick Scale

A six grade system (0-5) based on the 'difficulty in walking'.

Classification Scheme:

* Grade 0: signs or symptoms of root involvement but without evidence of spinal cord disease

* Grade 1: signs of spinal cord disease but no difficulty in walking.

* Grade 2: slight difficulty in walking which does not prevent full-time employment

* Grade 3: difficulty in walking which prevented full time employment or the ability to do all housework, but which was not so severe as to require someone else's help to walk

* Grade 4: able to walk only with someone else's help or with the aid of a frame.

* Grade 5 : chairbound or bedridden.

The nuricks grade is used to compare the preoperative status with the postoperative surgical outcome.

Kaplan et al in 2006 studied the outcome of operative treatment of CSM and found the nuricks score correlated well with the radiological findings.

The other favorable prognostic indicators for improvement after surgery were a diagnosis of CSM and preoperative Nurick Grade 5; however, patients with a preoperative Nurick grade of 4 were more likely to experience a cure. [rajasekar et al 2005.

Laminoplasty is a technique whereby preserving the posterior elements maintains the tension band of the spine over the operative segment. This reduces the potential for postoperative kyphosis. Both laminectomy and laminoplasty do not require fusion in the lordotic spine; However, the loss of lordosis following laminectomy is greater than seen in laminoplasty and associated with poor outcome in terms of post operative sub axial pain. Guigui et al 1998.

Myelopathic individuals > 65 years of recover well in the short-term but not in the long-term following laminectomy. Ebersold et al proposed that immediate postoperative neurological improvement were comparable following both laminectomy (68%) and anterior surgical procedures (72%). But long term follow up of complications is more with laminectomy [10%], than with anterior procedures [2%].

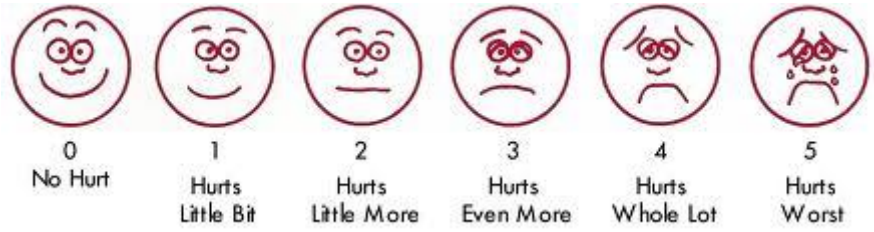
Kato et al concluded a similar picture showing the long term complication rate for laminectomy greater than anterior procedures.

Factors associated with increased deterioration rate are :

1. Age > 70 yrs at the time of surgery.
2. Severe myelopathy at the time of surgery.
3. Recent trauma.

PAIN

Pain is one of the major complaint in patient with myelopathy and radiculopathy. There are many pain scales to assess the severity of pain in a patient. In our study WONG- BAKER pain scale was used to assess the pre op and post op severity of pain.



Posterior muscle atrophy and its detachment may play a vital role in the pathogenesis of axial pain. Posterior muscle atrophy following operative treatment may relate to severe postoperative axial pain. Axial neck pain within a few months after surgery is due to trauma to the muscles during surgery, but chronic axial pain is because of the imbalance of the flexor and extensor muscle groups. The increase in muscle strength may potentially diminish axial pain.[Wang et al 2011].

OUTCOME
&
ANALYSIS

OUTCOME & ANALYSIS

AGE GROUP * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Age Group	1	Count	1	1	2
		% within complaints	4.0%	6.3%	4.9%
		% of Total	2.4%	2.4%	4.9%
	2	Count	3	4	7
		% within complaints	12.0%	25.0%	17.1%
		% of Total	7.3%	9.8%	17.1%
	3	Count	9	6	15
		% within complaints	36.0%	37.5%	36.6%
		% of Total	22.0%	14.6%	36.6%
	4	Count	4	3	7
		% within complaints	16.0%	18.8%	17.1%
		% of Total	9.8%	7.3%	17.1%
	5	Count	6	2	8
		% within complaints	24.0%	12.5%	19.5%
		% of Total	14.6%	4.9%	19.5%
	6	Count	2	0	2
		% within complaints	8.0%	.0%	4.9%
		% of Total	4.9%	.0%	4.9%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.057[a]	5	.691
Likelihood Ratio	3.765	5	.584
Linear-by-Linear Association	2.321	1	.128
N of Valid Cases	41		

a. 10 cells (83.3%) have expected count less than 5. The minimum expected count is .78.

SEX * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Sex	female	Count	5	3	8
		% within complaints	20.0%	18.8%	19.5%
		% of Total	12.2%	7.3%	19.5%
	male	Count	20	13	33
		% within complaints	80.0%	81.3%	80.5%
		% of Total	48.8%	31.7%	80.5%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.010[a]	1	.922		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.010	1	.921		
Fisher's Exact Test				1.000	.626
N of Valid Cases	41				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.12.

b. Computed only for a 2x2 table

OCCUPATION * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Occupation	1	Count	7	2	9
		% within complaints	28.0%	12.5%	22.0%
		% of Total	17.1%	4.9%	22.0%
	2	Count	11	8	19
		% within complaints	44.0%	50.0%	46.3%
		% of Total	26.8%	19.5%	46.3%
	3	Count	3	0	3
		% within complaints	12.0%	.0%	7.3%
		% of Total	7.3%	.0%	7.3%
	4	Count	4	6	10
		% within complaints	16.0%	37.5%	24.4%
		% of Total	9.8%	14.6%	24.4%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.913[a]	3	.178
Likelihood Ratio	5.987	3	.112
Linear-by-Linear Association	1.787	1	.181
N of Valid Cases	41		

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.17.

MARITAL STATUS * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Marital status	Married	Count	24	15	39
		% within complaints	96.0%	93.8%	95.1%
		% of Total	58.5%	36.6%	95.1%
	Single	Count	0	1	1
		% within complaints	.0%	6.3%	2.4%
		% of Total	.0%	2.4%	2.4%
	Unmarried	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.208[a]	2	.332
Likelihood Ratio	2.877	2	.237
N of Valid Cases	41		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .39.

RISK FACTORS * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Risk factors	1	Count	8	7	15
		% within complaints	32.0%	43.8%	36.6%
		% of Total	19.5%	17.1%	36.6%
	1,2	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	1,2,3,6	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	1,2,6	Count	0	1	1
		% within complaints	.0%	6.3%	2.4%
		% of Total	.0%	2.4%	2.4%
	1,3	Count	2	1	3
		% within complaints	8.0%	6.3%	7.3%
		% of Total	4.9%	2.4%	7.3%
	1,4	Count	1	1	2
		% within complaints	4.0%	6.3%	4.9%
		% of Total	2.4%	2.4%	4.9%
	1,4,6	Count	0	1	1
		% within complaints	.0%	6.3%	2.4%
		% of Total	.0%	2.4%	2.4%
	1,5	Count	0	1	1
		% within complaints	.0%	6.3%	2.4%
		% of Total	.0%	2.4%	2.4%
	1,6	Count	4	1	5
		% within complaints	16.0%	6.3%	12.2%
		% of Total	9.8%	2.4%	12.2%
	2	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	3	Count	1	1	2
		% within complaints	4.0%	6.3%	4.9%
		% of Total	2.4%	2.4%	4.9%

			Complaints		Total
			1	2	
	4,6	Count	6	1	7
		% within complaints	24.0%	6.3%	17.1%
		% of Total	14.6%	2.4%	17.1%
	5	Count	0	1	1
		% within complaints	.0%	6.3%	2.4%
		% of Total	.0%	2.4%	2.4%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.342[a]	12	.500
Likelihood Ratio	14.009	12	.300
N of Valid Cases	41		

a. 24 cells (92.3%) have expected count less than 5. The minimum expected count is .39.

RISK FACTORS * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Risk Factors	1	Count	10	9	19
		% within complaints	40.0%	56.3%	46.3%
		% of Total	24.4%	22.0%	46.3%
	2	Count	15	7	22
		% within complaints	60.0%	43.8%	53.7%
		% of Total	36.6%	17.1%	53.7%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.036[a]	1	.309		
Continuity Correction[b]	.486	1	.486		
Likelihood Ratio	1.038	1	.308		
Fisher's Exact Test				.352	.243
Linear-by-Linear Association	1.011	1	.315		
N of Valid Cases	41				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.41.

b. Computed only for a 2x2 table

DURATION * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Duration	1	Count	0	2	2
		% within complaints	.0%	12.5%	4.9%
		% of Total	.0%	4.9%	4.9%
	2	Count	20	11	31
		% within complaints	80.0%	68.8%	75.6%
		% of Total	48.8%	26.8%	75.6%
	3	Count	5	3	8
		% within complaints	20.0%	18.8%	19.5%
		% of Total	12.2%	7.3%	19.5%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.296[a]	2	.192
Likelihood Ratio	3.937	2	.140
Linear-by-Linear Association	.809	1	.368
N of Valid Cases	41		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .78.

PRE OP PAIN * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Pre-op-Pain	1	Count	3	1	4
		% within complaints	12.0%	6.3%	9.8%
		% of Total	7.3%	2.4%	9.8%
	2	Count	13	2	15
		% within complaints	52.0%	12.5%	36.6%
		% of Total	31.7%	4.9%	36.6%
	3	Count	6	2	8
		% within complaints	24.0%	12.5%	19.5%
		% of Total	14.6%	4.9%	19.5%
	4	Count	2	6	8
		% within complaints	8.0%	37.5%	19.5%
		% of Total	4.9%	14.6%	19.5%
	5	Count	1	5	6
		% within complaints	4.0%	31.3%	14.6%
		% of Total	2.4%	12.2%	14.6%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.454[a]	4	.006
Likelihood Ratio	15.166	4	.004
Linear-by-Linear Association	11.329	1	.001
N of Valid Cases	41		

a. 8 cells (80.0%) have expected count less than 5. The minimum expected count is 1.56.

PRE OP MRI CSPINE * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Pre-op-MRI Cspine	1	Count	0	6	6
		% within complaints	.0%	37.5%	14.6%
		% of Total	.0%	14.6%	14.6%
	1,3	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	2	Count	1	10	11
		% within complaints	4.0%	62.5%	26.8%
		% of Total	2.4%	24.4%	26.8%
	2,3	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	3	Count	9	0	9
		% within complaints	36.0%	.0%	22.0%
		% of Total	22.0%	.0%	22.0%
	3,5	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	3,5,6	Count	2	0	2
		% within complaints	8.0%	.0%	4.9%
		% of Total	4.9%	.0%	4.9%
	3,6	Count	3	0	3
		% within complaints	12.0%	.0%	7.3%
		% of Total	7.3%	.0%	7.3%
	4,6	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	5	Count	4	0	4
		% within complaints	16.0%	.0%	9.8%
		% of Total	9.8%	.0%	9.8%
	5,6	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	6	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.180[a]	11	.000
Likelihood Ratio	48.144	11	.000
N of Valid Cases	41		

a. 22 cells (91.7%) have expected count less than 5. The minimum expected count is .39.

MR DIMENSION * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
MR Dimension	s1	Count	22	3	25
		% within complaints	88.0%	18.8%	61.0%
		% of Total	53.7%	7.3%	61.0%
	s2	Count	2	11	13
		% within complaints	8.0%	68.8%	31.7%
		% of Total	4.9%	26.8%	31.7%
	s3	Count	1	2	3
		% within complaints	4.0%	12.5%	7.3%
		% of Total	2.4%	4.9%	7.3%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.992[a]	2	.000
Likelihood Ratio	21.519	2	.000
N of Valid Cases	41		

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 1.17.

RESPONSE * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Response	0	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value
Pearson Chi-Square	.[a]
N of Valid Cases	41

a. No statistics are computed because response is a constant.

SURGICAL MANAGEMENT * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Surgical Management	1	Count	1	15	16
		% within complaints	4.0%	93.8%	39.0%
		% of Total	2.4%	36.6%	39.0%
	2	Count	5	1	6
		% within complaints	20.0%	6.3%	14.6%
		% of Total	12.2%	2.4%	14.6%
	3	Count	7	0	7
		% within complaints	28.0%	.0%	17.1%
		% of Total	17.1%	.0%	17.1%
	4	Count	11	0	11
		% within complaints	44.0%	.0%	26.8%
		% of Total	26.8%	.0%	26.8%
	5	Count	1	0	1
		% within complaints	4.0%	.0%	2.4%
		% of Total	2.4%	.0%	2.4%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.558[a]	4	.000
Likelihood Ratio	41.958	4	.000
Linear-by-Linear Association	26.526	1	.000
N of Valid Cases	41		

a. 7 cells (70.0%) have expected count less than 5. The minimum expected count is .39.

PRE OP XRAY * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Pre-op-Xray	1	Count	2	1	3
		% within complaints	8.0%	6.3%	7.3%
		% of Total	4.9%	2.4%	7.3%
	2	Count	2	2	4
		% within complaints	8.0%	12.5%	9.8%
		% of Total	4.9%	4.9%	9.8%
	3	Count	5	1	6
		% within complaints	20.0%	6.3%	14.6%
		% of Total	12.2%	2.4%	14.6%
	5	Count	12	1	13
		% within complaints	48.0%	6.3%	31.7%
		% of Total	29.3%	2.4%	31.7%
	6	Count	4	11	15
		% within complaints	16.0%	68.8%	36.6%
		% of Total	9.8%	26.8%	36.6%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.287[a]	4	.006
Likelihood Ratio	15.627	4	.004
Linear-by-Linear Association	1.891	1	.169
N of Valid Cases	41		

a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.17.

POST OP XRAY * COMPLAINTS

Crosstab

			Complaints		Total
			1	2	
Post-op-Xray	1	Count	5	1	6
		% within complaints	20.0%	6.3%	14.6%
		% of Total	12.2%	2.4%	14.6%
	2	Count	5	1	6
		% within complaints	20.0%	6.3%	14.6%
		% of Total	12.2%	2.4%	14.6%
	3	Count	2	0	2
		% within complaints	8.0%	.0%	4.9%
		% of Total	4.9%	.0%	4.9%
	4	Count	6	0	6
		% within complaints	24.0%	.0%	14.6%
		% of Total	14.6%	.0%	14.6%
	5	Count	0	1	1
		% within complaints	.0%	6.3%	2.4%
		% of Total	.0%	2.4%	2.4%
	6	Count	7	13	20
		% within complaints	28.0%	81.3%	48.8%
		% of Total	17.1%	31.7%	48.8%
	Total	Count	25	16	41
		% within complaints	100.0%	100.0%	100.0%
		% of Total	61.0%	39.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.874[a]	5	.011
Likelihood Ratio	18.135	5	.003
Linear-by-Linear Association	8.812	1	.003
N of Valid Cases	41		

a. 10 cells (83.3%) have expected count less than 5. The minimum expected ount is .39.

DESCRIPTIVES

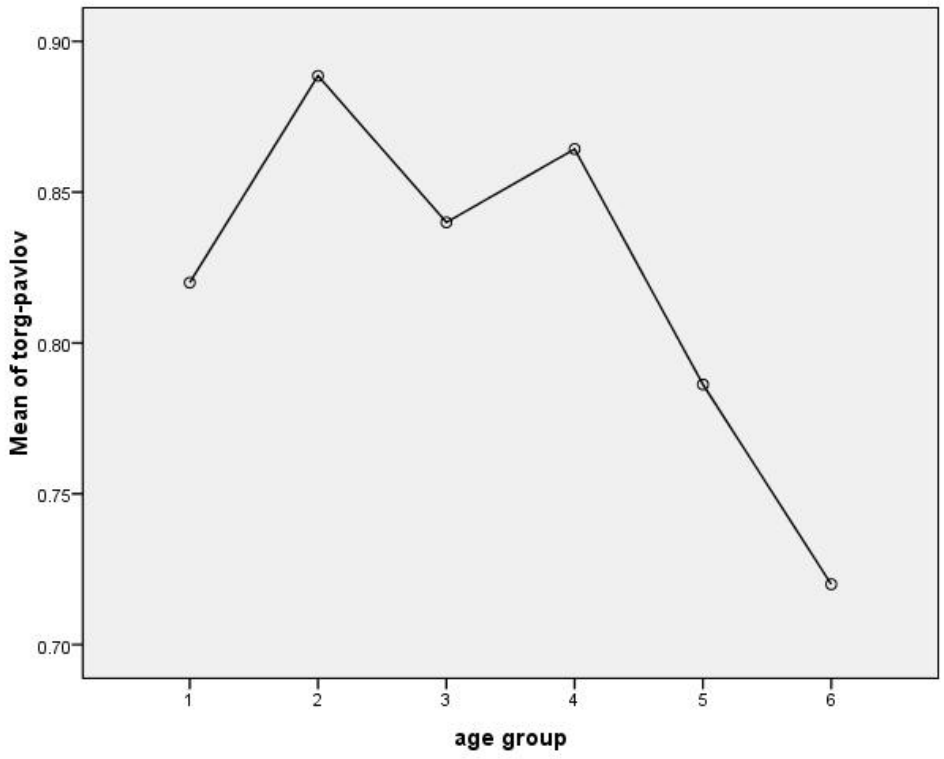
						95% Confidence Interval for Mean	
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
pre op pain	1	2	3.00	1.414	1.000	-9.71	15.71
	2	7	3.43	1.512	.571	2.03	4.83
	3	15	2.80	1.207	.312	2.13	3.47
	4	7	3.43	1.272	.481	2.25	4.61
	5	8	2.50	1.195	.423	1.50	3.50
	6	2	2.00	.000	.000	2.00	2.00
	Total	41	2.93	1.253	.196	2.53	3.32
torg-pavlov	1	2	.8200	.05657	.04000	.3118	1.3282
	2	7	.8886	.08611	.03255	.8089	.9682
	3	15	.8400	.09103	.02350	.7896	.8904
	4	7	.8643	.07955	.03007	.7907	.9379
	5	8	.7862	.08927	.03156	.7116	.8609
	6	2	.7200	.02828	.02000	.4659	.9741
	Total	41	.8351	.09092	.01420	.8064	.8638
nurick's pre op	1	2	2.00	2.828	2.000	-23.41	27.41
	2	7	1.29	1.704	.644	-.29	2.86
	3	15	1.60	1.724	.445	.65	2.55
	4	7	2.14	2.035	.769	.26	4.03
	5	8	2.50	1.852	.655	.95	4.05
	6	2	2.00	1.414	1.000	-10.71	14.71
	Total	41	1.85	1.769	.276	1.30	2.41
nurick's post op	1	2	1.00	1.414	1.000	-11.71	13.71
	2	7	.43	.535	.202	-.07	.92
	3	15	.93	1.163	.300	.29	1.58
	4	7	1.29	1.380	.522	.01	2.56
	5	8	1.50	1.512	.535	.24	2.76
	6	2	.50	.707	.500	-5.85	6.85
	Total	41	1.00	1.183	.185	.63	1.37
post op pain	1	2	1.00	.000	.000	1.00	1.00
	2	7	.71	.756	.286	.02	1.41
	3	15	.73	.594	.153	.40	1.06
	4	7	.43	.535	.202	-.07	.92
	5	8	.88	.641	.227	.34	1.41
	6	2	1.00	.000	.000	1.00	1.00
	Total	41	.73	.593	.093	.54	.92

DESCRIPTIVES

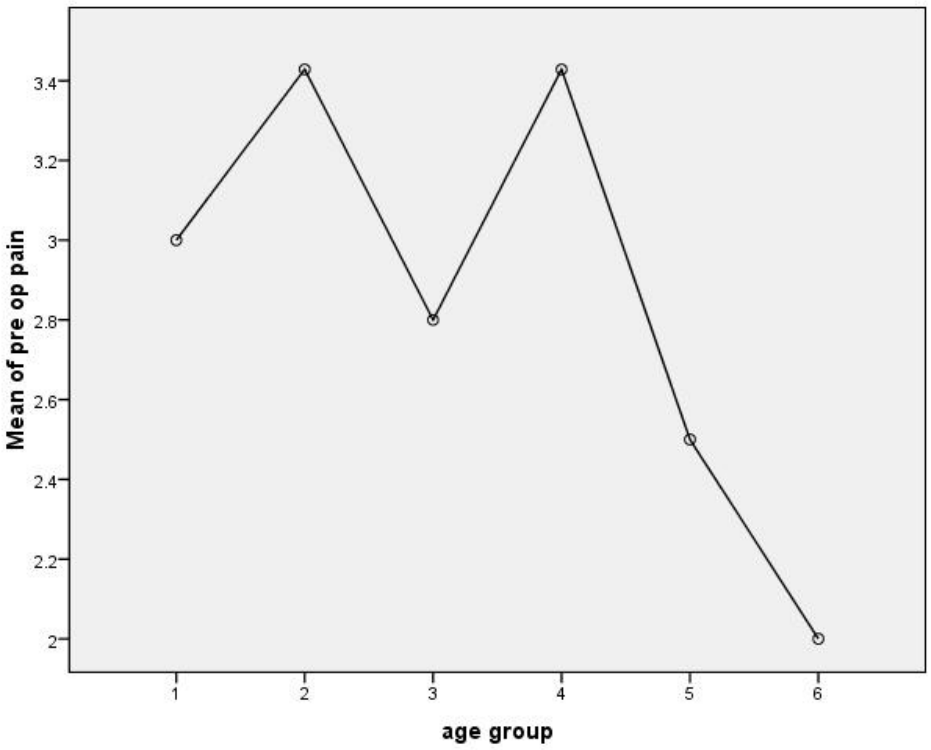
		Minimum	Maximum
pre op pain	1	2	4
	2	1	5
	3	1	5
	4	2	5
	5	1	5
	6	2	2
	Total	1	5
torg-pavlov	1	.78	.86
	2	.76	.98
	3	.68	.98
	4	.78	.99
	5	.68	.89
	6	.70	.74
	Total	.68	.99
nurick's pre op	1	0	4
	2	0	4
	3	0	5
	4	0	4
	5	0	5
	6	1	3
	Total	0	5
nurick's post op	1	0	2
	2	0	1
	3	0	4
	4	0	3
	5	0	4
	6	0	1
	Total	0	4
post op pain	1	1	1
	2	0	2
	3	0	2
	4	0	1
	5	0	2
	6	1	1
	Total	0	2

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
pre op pain	Between Groups	6.952	5	1.390	.872	.510
	Within Groups	55.829	35	1.595		
	Total	62.780	40			
torg-pavlov	Between Groups	.072	5	.014	1.962	.109
	Within Groups	.258	35	.007		
	Total	.331	40			
nurick's pre op	Between Groups	7.236	5	1.447	.430	.825
	Within Groups	117.886	35	3.368		
	Total	125.122	40			
nurick's post op	Between Groups	5.424	5	1.085	.751	.591
	Within Groups	50.576	35	1.445		
	Total	56.000	40			
post op pain	Between Groups	1.098	5	.220	.593	.705
	Within Groups	12.951	35	.370		
	Total	14.049	40			



MEANS PLOTS


Mean of pre op pain
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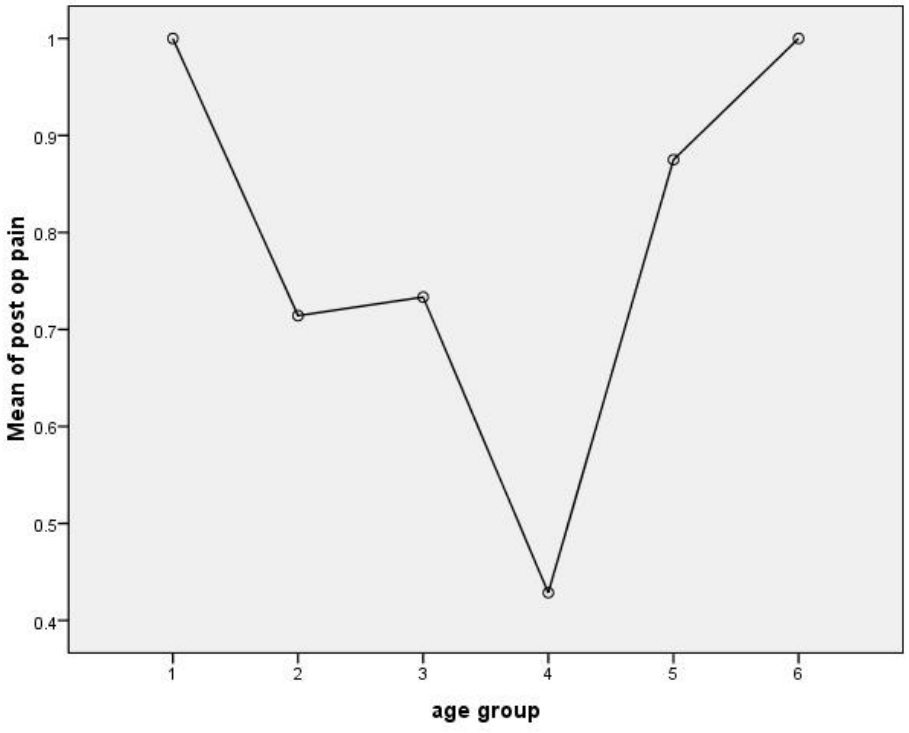
3.2
3
2.8
2.6
2.4
2.2
2
1
2
3
4
5
6
age group


Mean of post op pain
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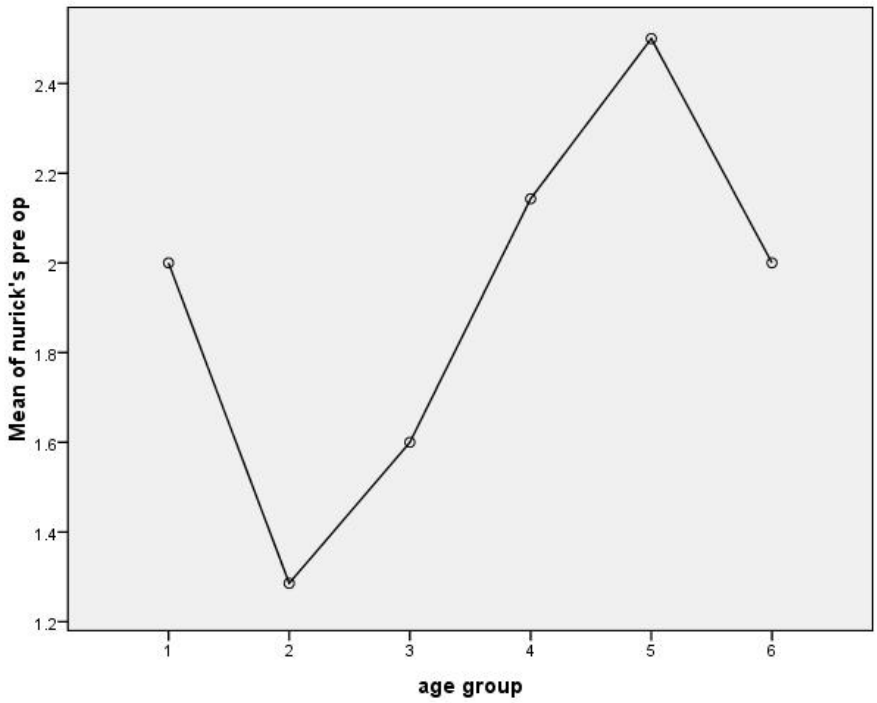
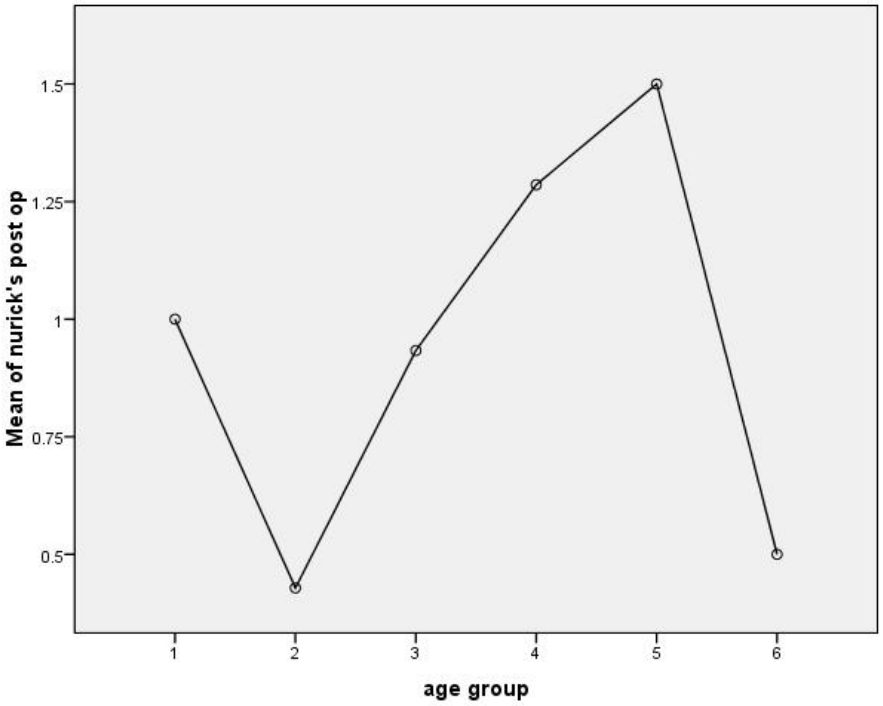
0.9
0.8
0.7
0.6
0.5
0.4
1
2
3
4
5
6
age group


Mean of nurick's pre op
2.4
2.2
2
1.8
1.6
1.4
1.2
1
2
3
4
5
6
age group


Mean of nurick's post op
1.5
1.25
1
0.75
0.5
1
2
3
4
5
6
age group

DESCRIPTIVES FOR MYELOPATHY AND RADICULOPATHY

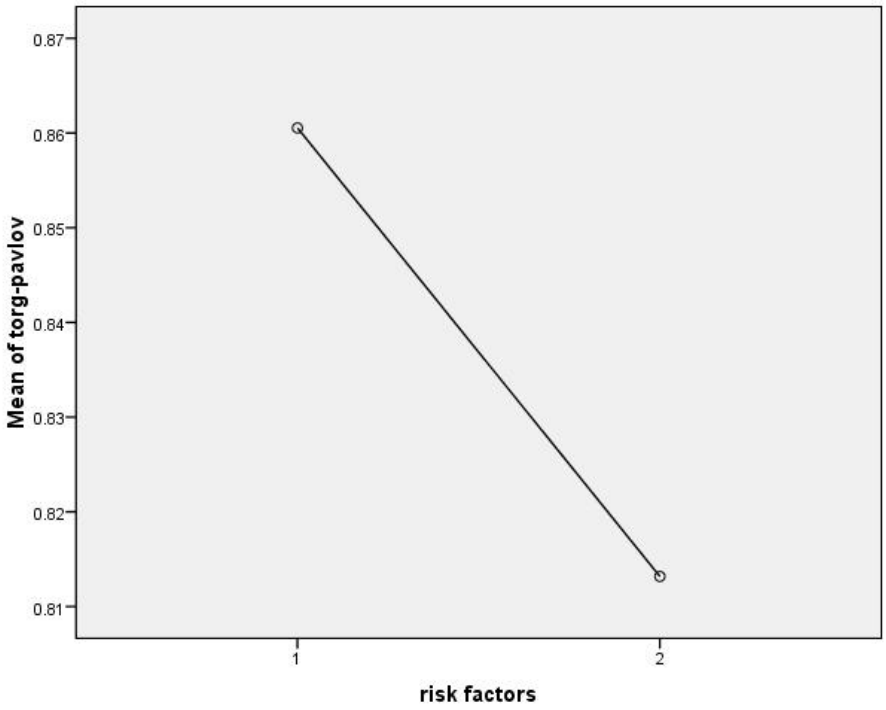
						95% Confidence Interval for Mean	
		N	Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound
pre op pain	1	19	3.16	1.344	.308	2.51	3.81
	2	22	2.73	1.162	.248	2.21	3.24
	Total	41	2.93	1.253	.196	2.53	3.32
torg-pavlov	1	19	.8605	.07785	.01786	.8230	.8980
	2	22	.8132	.09727	.02074	.7701	.8563
	Total	41	.8351	.09092	.01420	.8064	.8638
nurick's pre op	1	19	1.63	1.707	.392	.81	2.45
	2	22	2.05	1.838	.392	1.23	2.86
	Total	41	1.85	1.769	.276	1.30	2.41
nurick's post op	1	19	.79	.918	.211	.35	1.23
	2	22	1.18	1.368	.292	.58	1.79
	Total	41	1.00	1.183	.185	.63	1.37
post op pain	1	19	.63	.597	.137	.34	.92
	2	22	.82	.588	.125	.56	1.08
	Total	41	.73	.593	.093	.54	.92

Descriptives

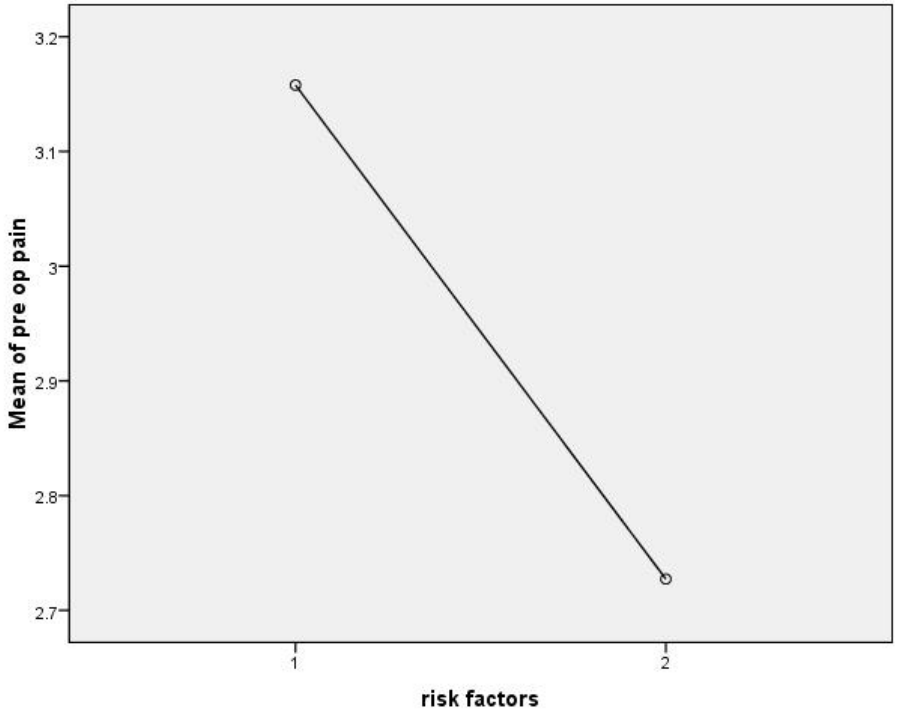
		Minimum	Maximum
pre op pain	1	1	5
	2	1	5
	Total	1	5
torg-pavlov	1	.72	.99
	2	.68	.98
	Total	.68	.99
nurick's pre op	1	0	4
	2	0	5
	Total	0	5
nurick's post op	1	0	3
	2	0	4
	Total	0	4
post op pain	1	0	2
	2	0	2
	Total	0	2

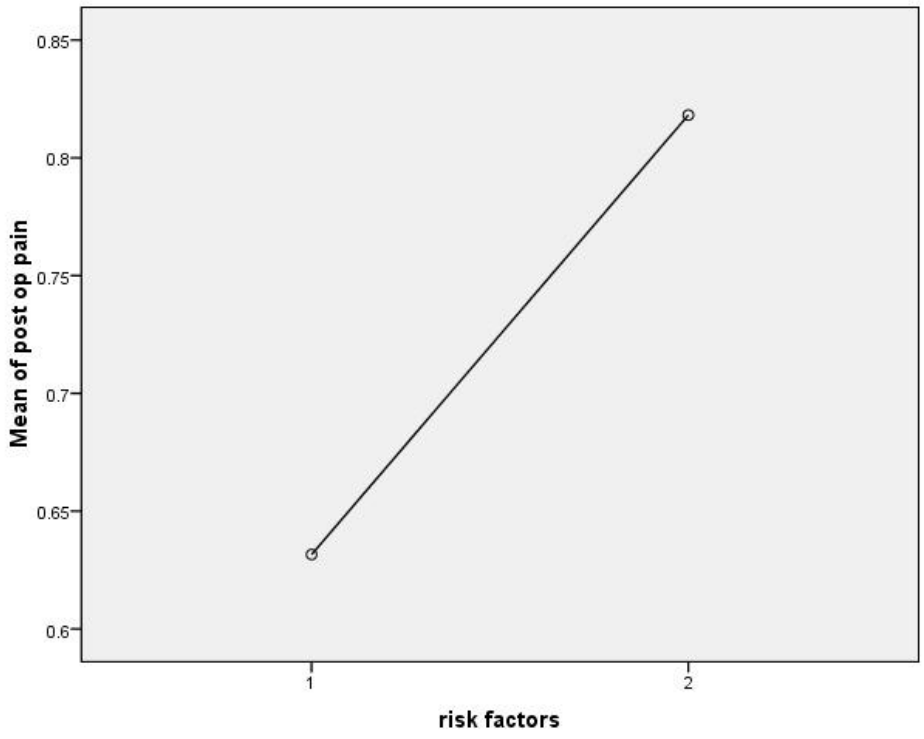
ANOVA

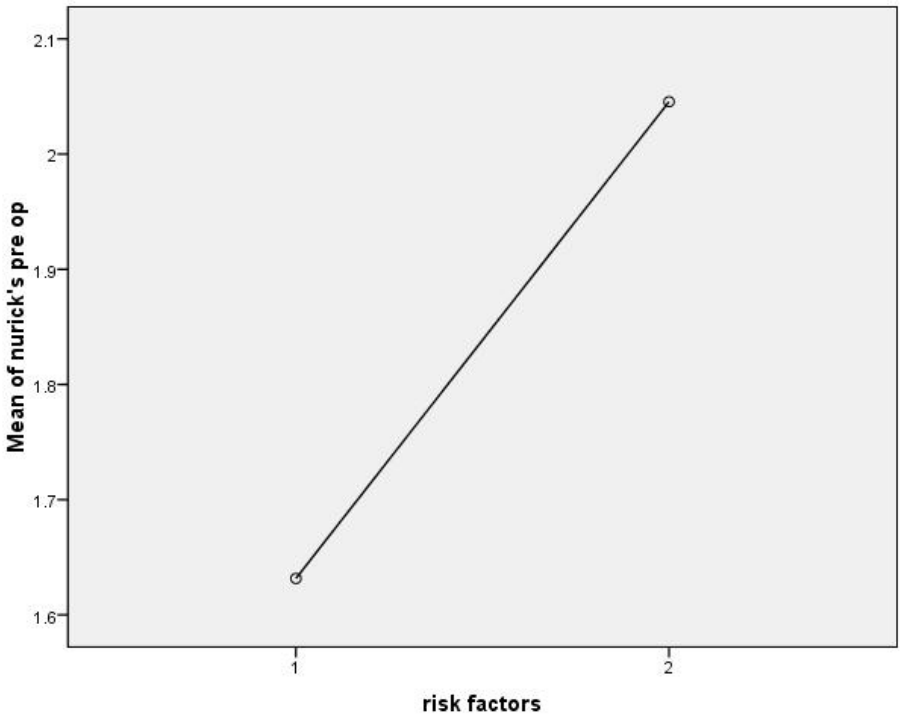
		Sum of Squares	df	Mean Square	F	Sig.
pre op pain	Between Groups	1.891	1	1.891	1.211	.278
	Within Groups	60.890	39	1.561		
	Total	62.780	40			
torg-pavlov	Between Groups	.023	1	.023	2.896	.097
	Within Groups	.308	39	.008		
	Total	.331	40			
nurick's pre op	Between Groups	1.746	1	1.746	.552	.462
	Within Groups	123.376	39	3.163		
	Total	125.122	40			
nurick's post op	Between Groups	1.569	1	1.569	1.124	.295
	Within Groups	54.431	39	1.396		
	Total	56.000	40			
post op pain	Between Groups	.355	1	.355	1.011	.321
	Within Groups	13.694	39	.351		
	Total	14.049	40			

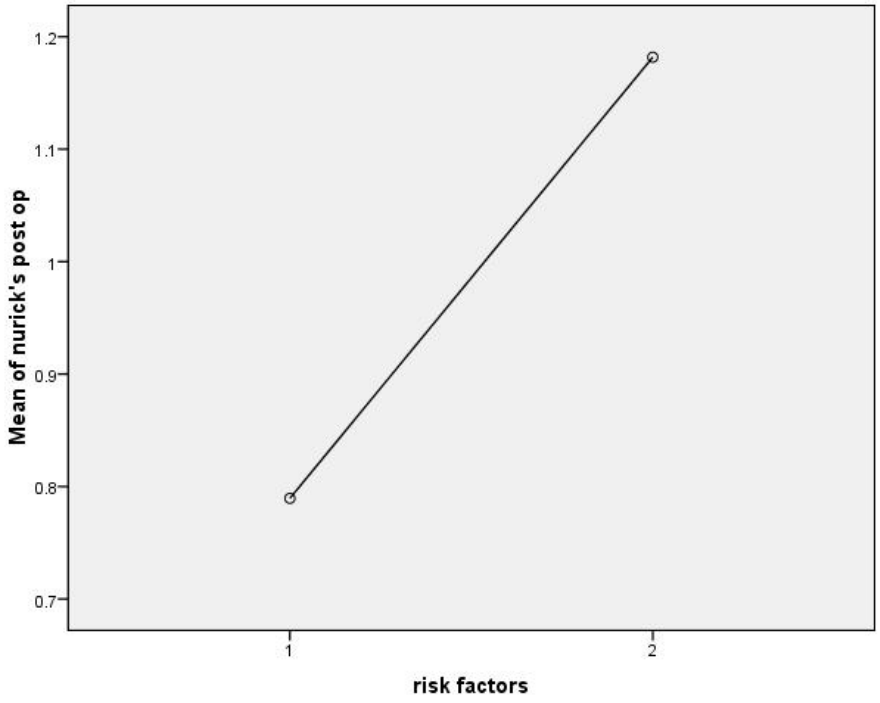


MEANS PLOTS


3.2
3.1
3
2.9
2.8
2.7
Mean of pre op pain
1
2
risk factors

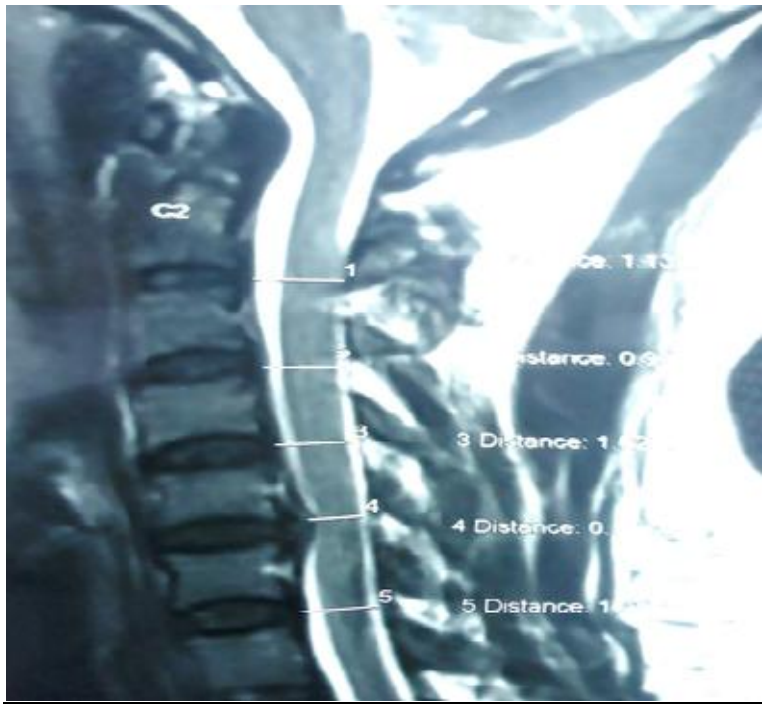

0.85
0.8
0.75
0.7
0.65
0.6
Mean of post op pain
1
2
risk factors


2.1
2
1.9
1.8
1.7
1.6
Mean of nurick's pre op
1
2
risk factors

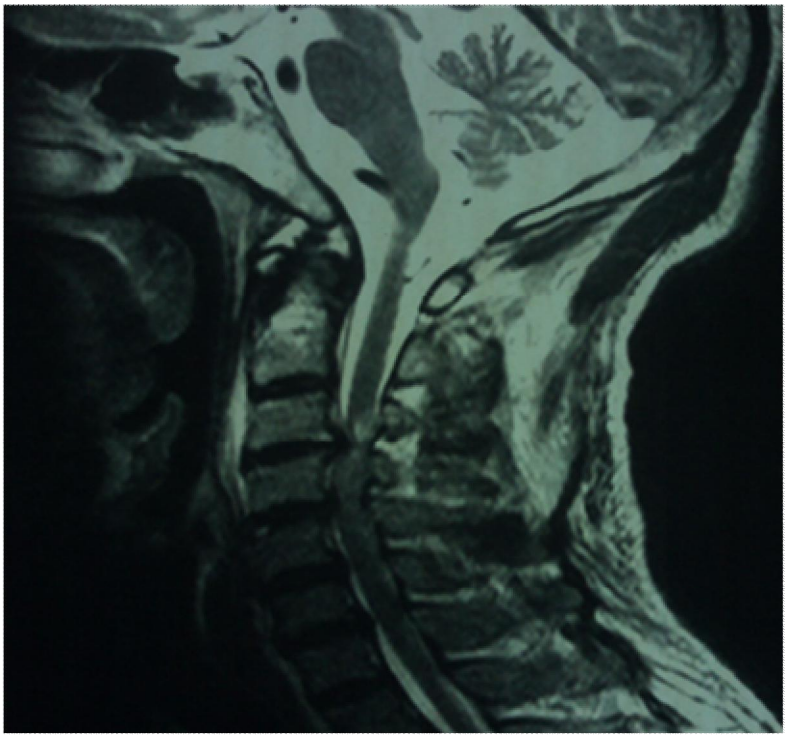

1.2
1.1
1
0.9
0.8
0.7
Mean of nurick's post op
1
2
risk factors

RESULTS
&
DISCUSSION

RESULTS & DISCUSSION



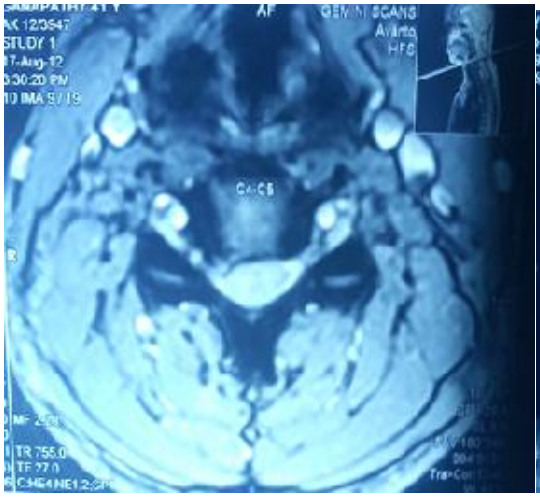
DISC OSTEOPHYTE COMPLEX COMPRESSING THE CORD

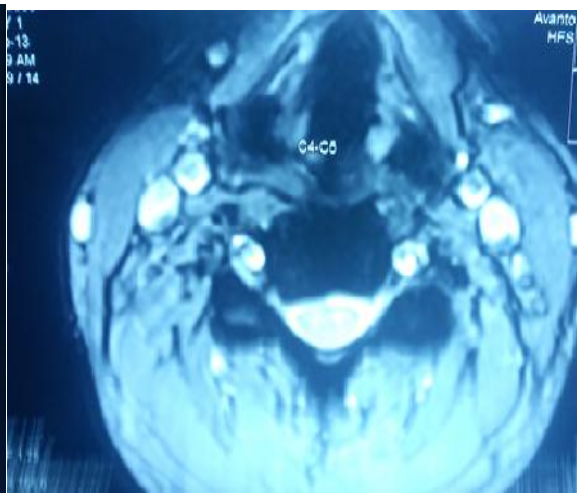


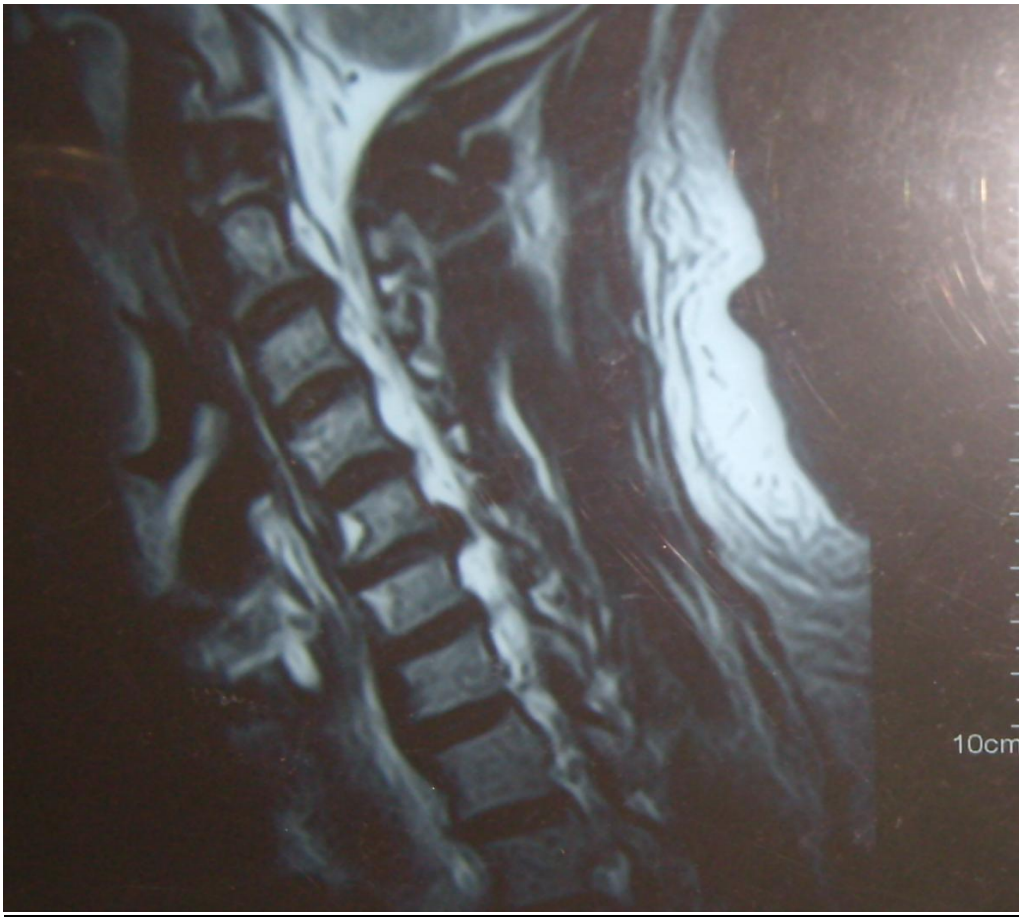
DISC OSTEOPHYTE COMPLEX COMPRESSING THE CORD WITH CORD INTENSITY CHANGES.

PREOP DISC BULGE

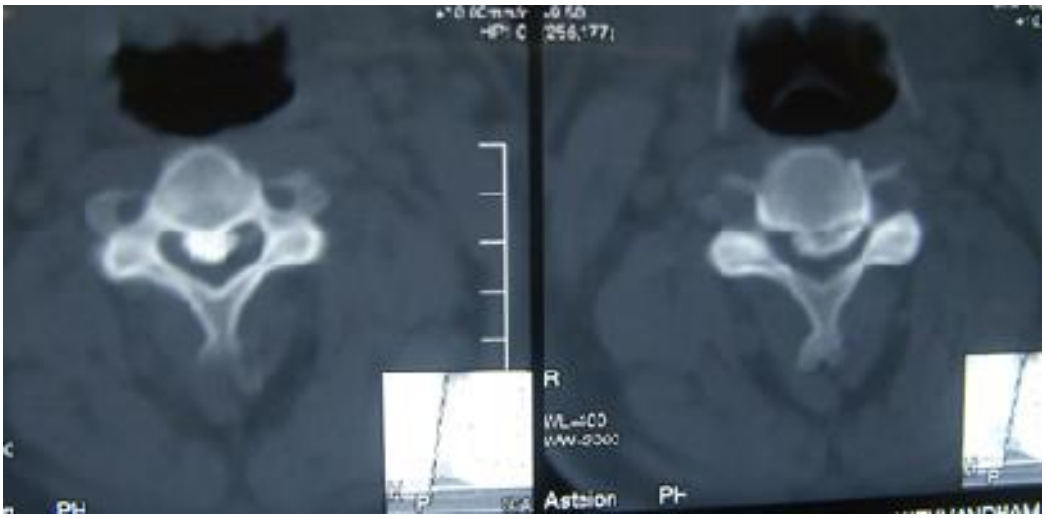
POST OP WITH BONE GRAFT AT THE SAME LEVEL





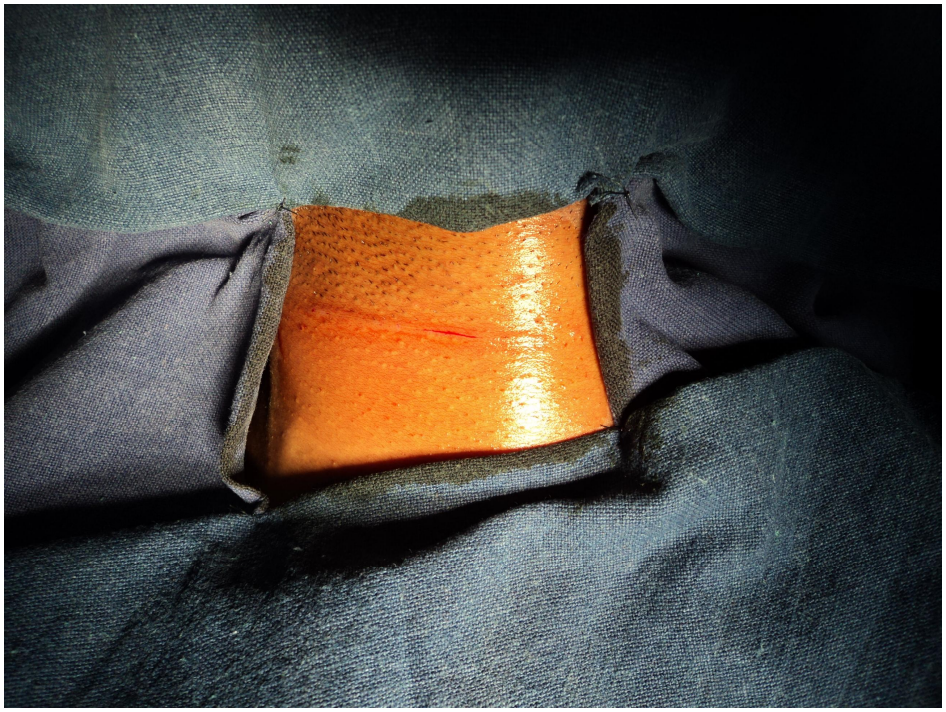


MRI C SPINE SHOWING OSSIFICATION OF POSTERIOR LONGITUDINAL LIGAMENT

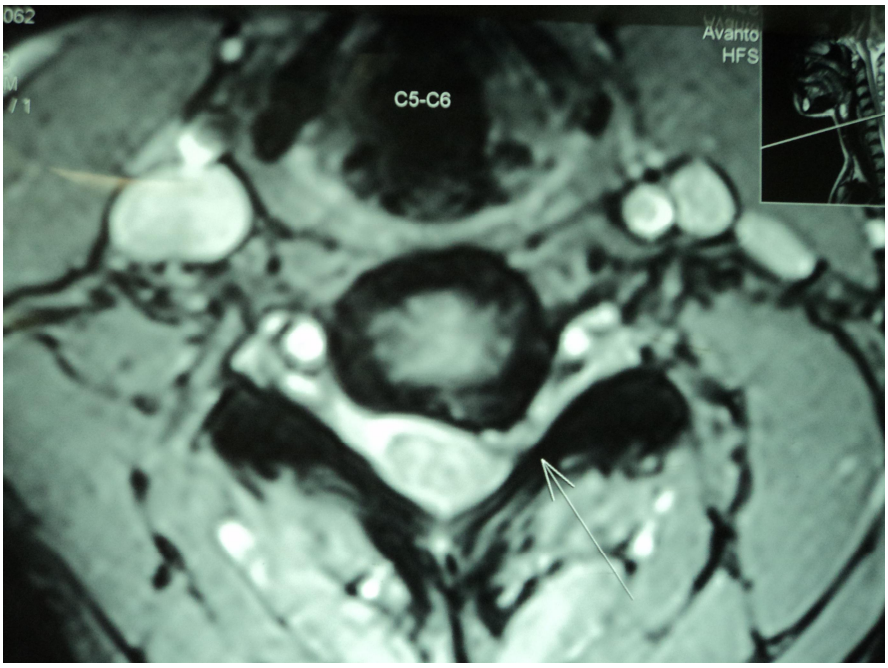


CT C SPINE OF THE SAME PATIENT SHOWING OPLL BEHIND THE DISC AND THE BODY

POSITIONING OF PATIENT IN ANTERIOR CERVICAL DISCECTOMY



TRANSVERSE SKIN CREASE INCISION FOR ANTERIOR CERVICAL DISCECTOMY

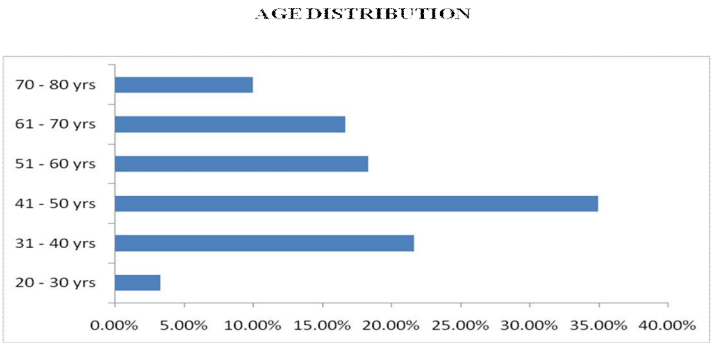


C5-C6 DISC BULGE COMPRESSING C-6 NERVE ROOT IN THE LEFT SIDE

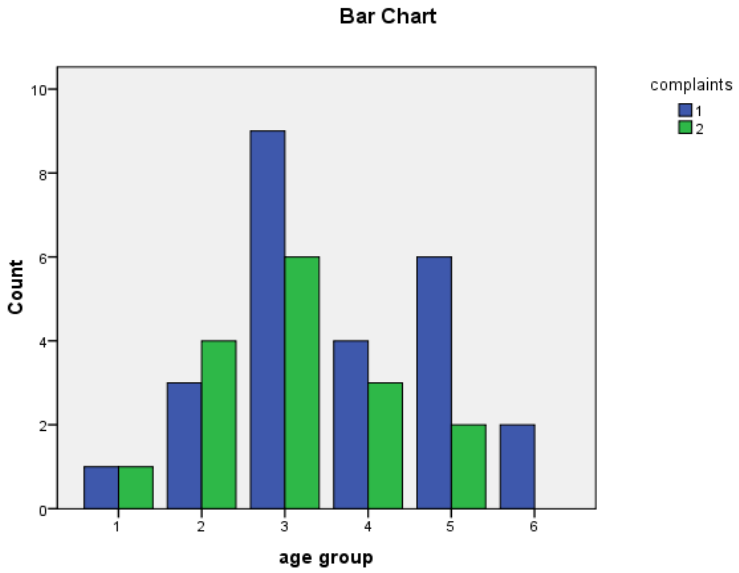
POST OF X-RAY C-SPINE

Correlating the 2 principal complaints with the sociodemographic data such as age group, sex, marital status and occupation the following statistical results were obtained.

Among the 41 patients treated with surgical measures 25 patients i.e. 61% presented with myelopathy and 16 patients i.e 39% presented radiculopathy.

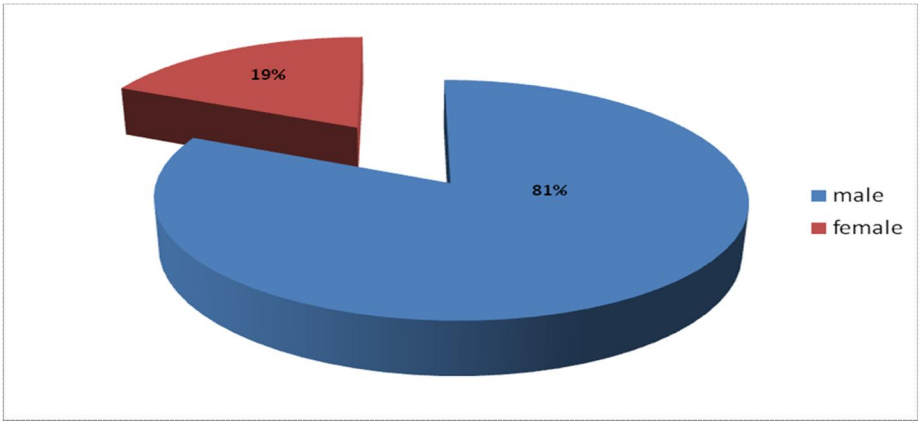


Critically analyzing the parameters the occurrence of symptoms was high in the group 3 which included patients between the age group 40 – 50 yrs of age. They comprised 36.6 % among the study group. p value ranged between 0.128 – 0.691 which falls above 0.05 hence statistically insignificant p value.

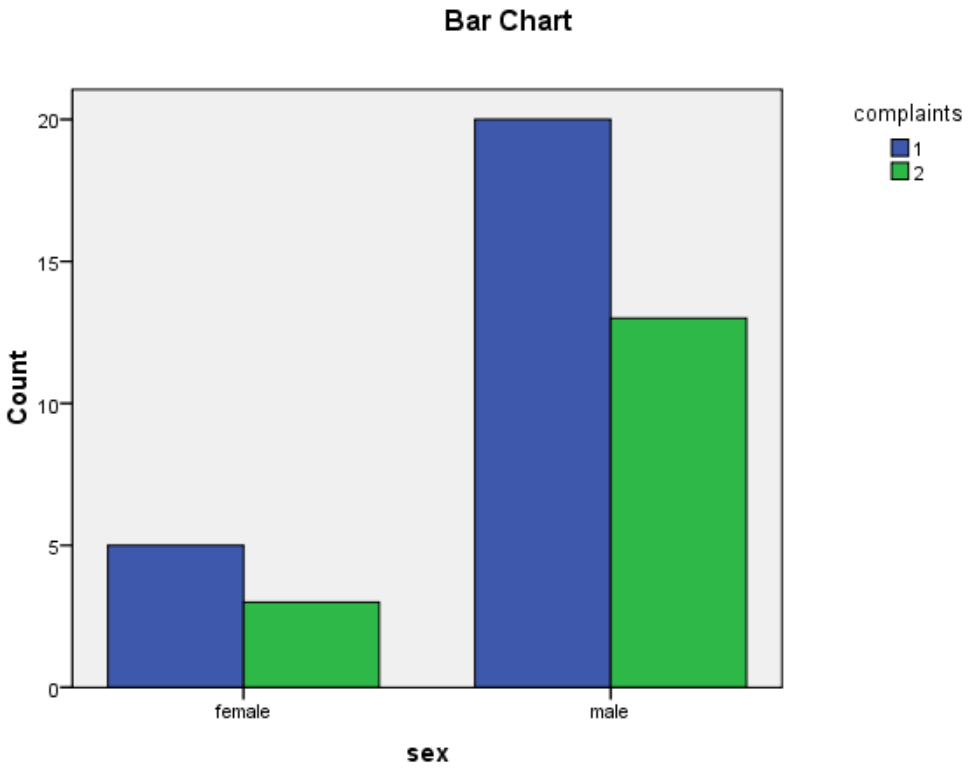


1 - Myelopathy 2 - Radiculopathy

GENDER DISTRIBUTION

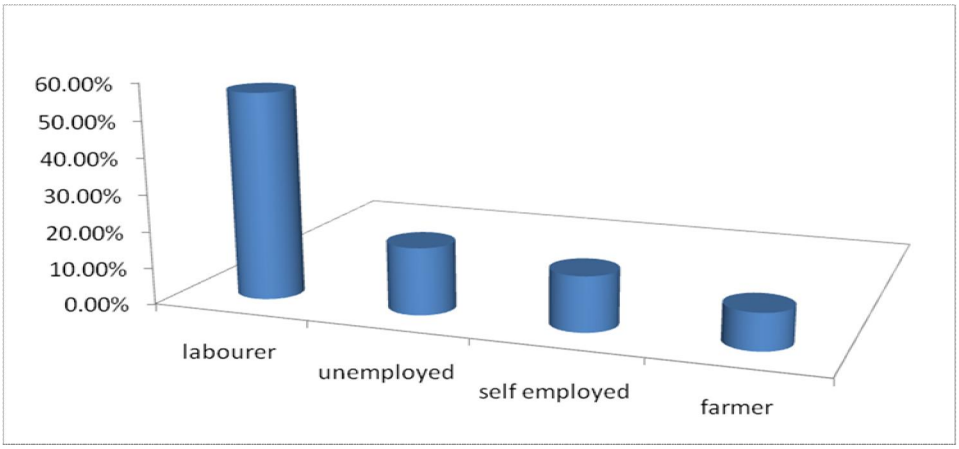


In this study group, both myelopathy and radiculopathy showed increased occurrence in male patients. But with statistically insignificant p value [0.626].

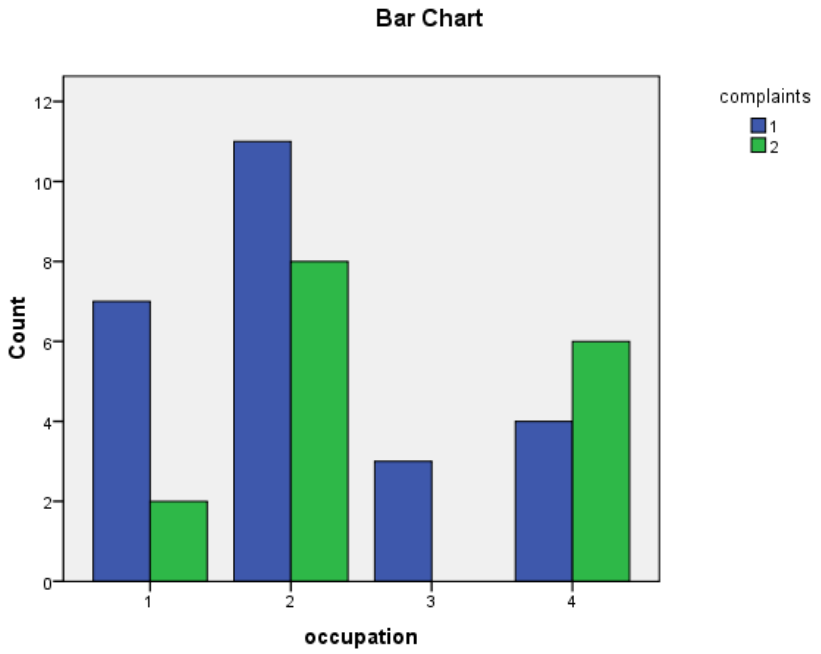


1 - Myelopathy 2 - Radiculopathy

OCCUPATION



Patients who were manual labourers presented with myelopathy and radiculopathy more than any other occupation.

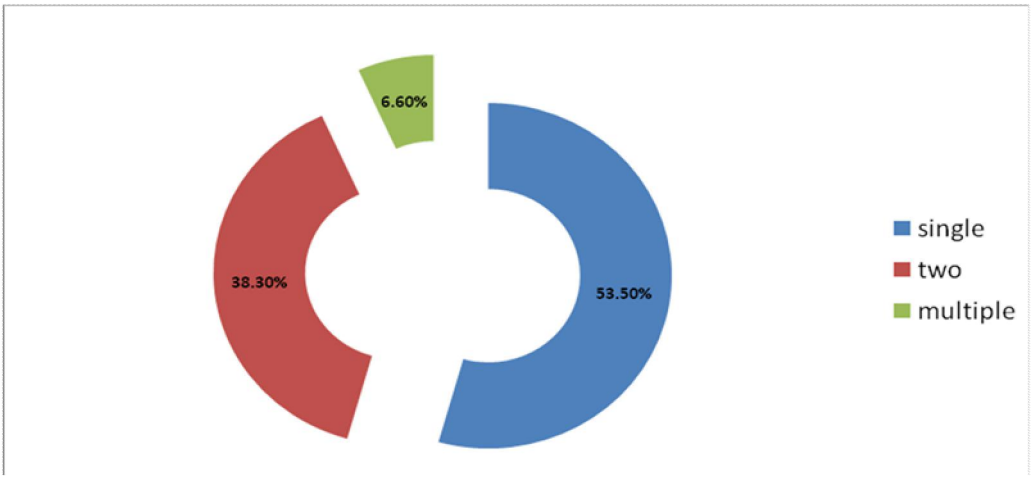


1 - Myelopathy 2 - Radiculopathy

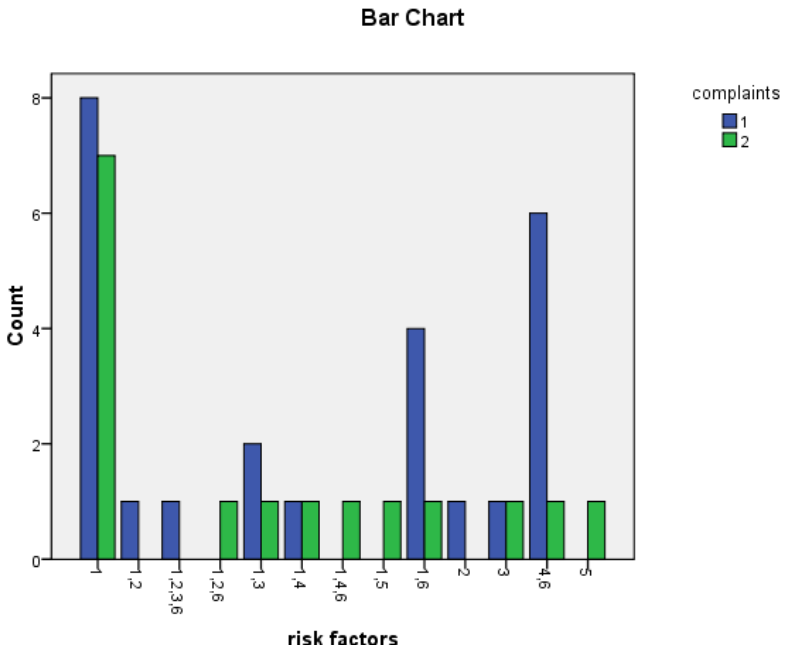
Occurrence of symptoms were more among the married population but with insignificant p value.

Among the patients with risk factors, multiple risk factor was seen in 44.9 %.

RISK FACTOR DISTRIBUTION

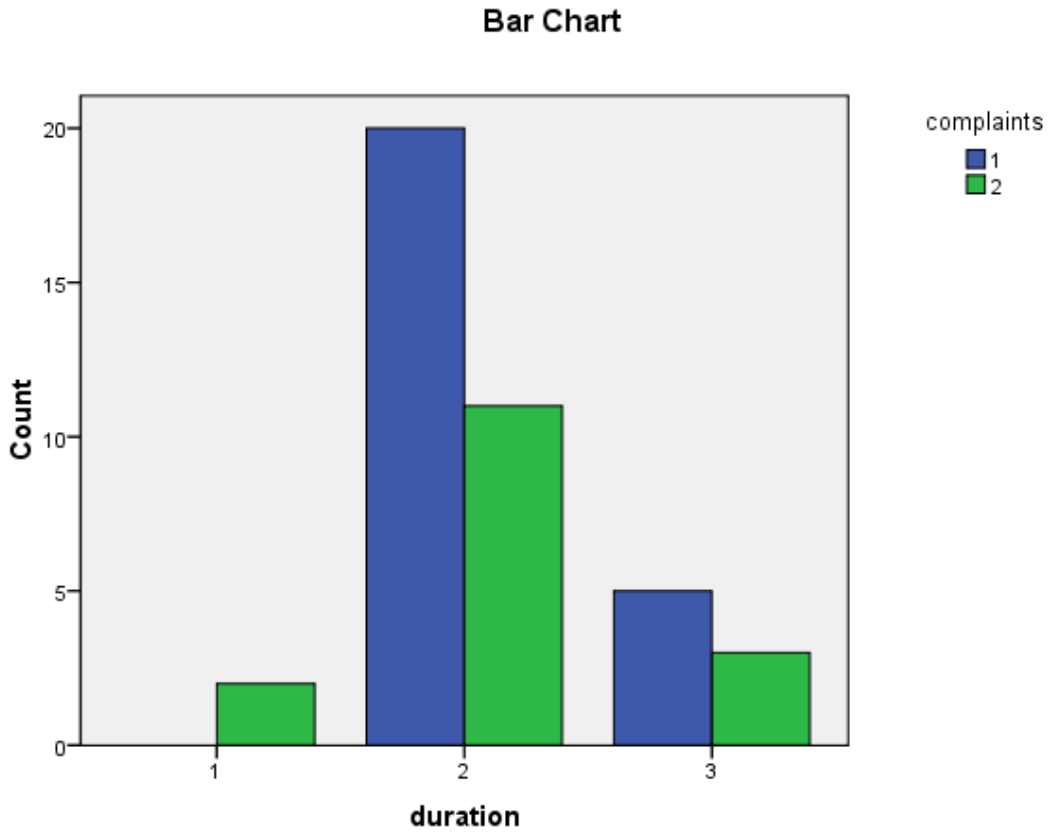


On cross tabulation of risk factors and complaints people who had occupation involving lifting heavy weights were seen in the majority of patients with myelopathy and radiculopathy but statistically insignificant.



1 - Myelopathy 2 - Radiculopathy

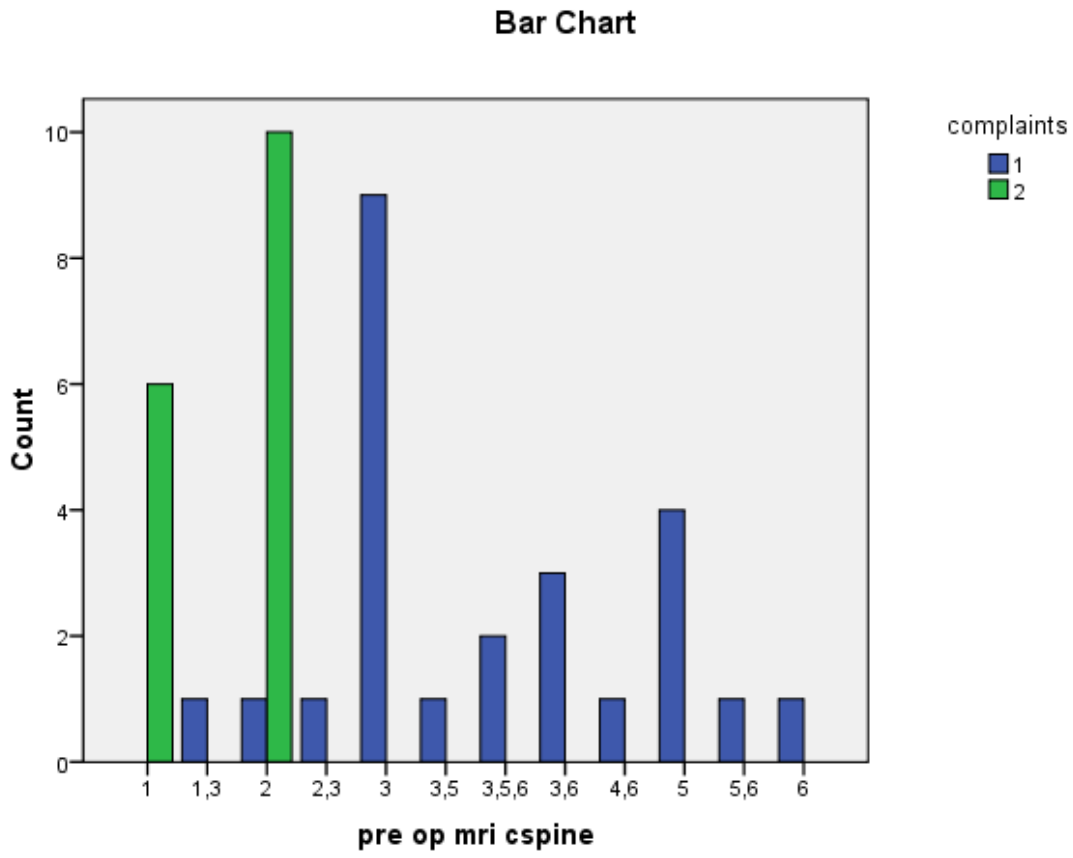
Duration and complaints were cross tabulated and symptoms for radiculopathy lasted for less than 1 month and for the myelopathy group it was more than 3 months and less than 1 year.



1 - Myelopathy 2 - Radiculopathy

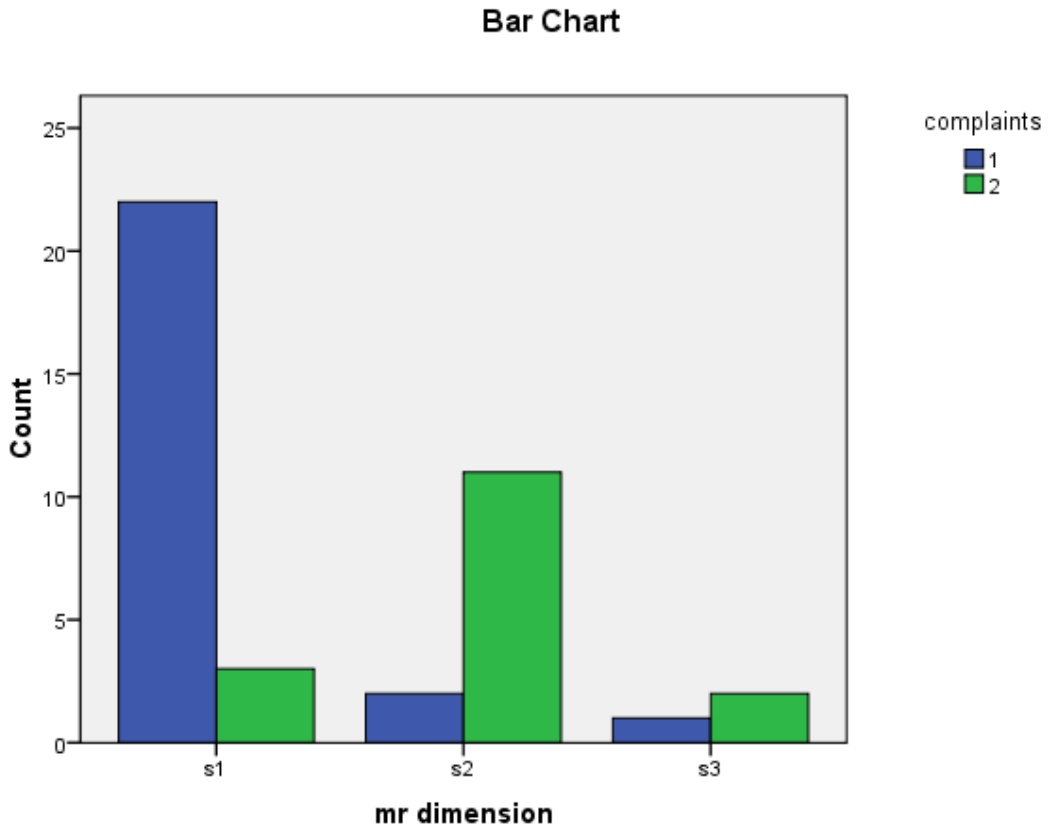
Patients with radiculopathy had predominantly disc bulge with no additional MR findings, whereas the patients with myelopathy had multiple compressive elements in the MR imaging like Ossification of Posterior Longitudinal Ligament, ligamentum flavum hypertrophy and disc osteophyte bulge.

Chi square testing with paired t test provided statistically significant p value of 0.001 when radiculopathy and myelopathy were compared.



1 - Myelopathy 2 - Radiculopathy

Correlating the MR dimension with myelopathy / radiculopathy, p value of 0.000 with maximum occurrence of myelopathy group having canal diameter less than 10 mm. Whereas in radiculopathy group the canal diameter fell within 10- 12 mm. This correlation has statistical significance.



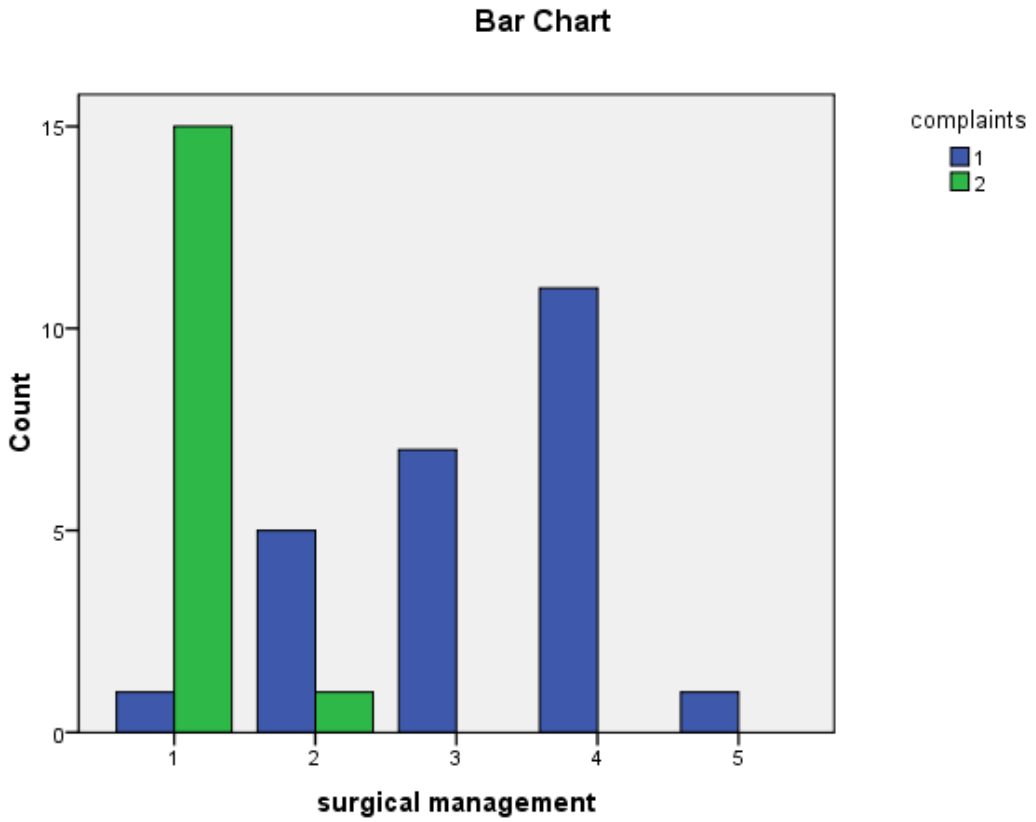
1 - Myelopathy 2 - Radiculopathy

Myelopathy patients underwent various treatment procedures :

11 patients underwent posterior cervical decompressive laminectomy, 7 patients underwent corpectomy + cage stabilization, 1 patient underwent corpectomy and bone graft fusion. 1 patient underwent anterior cervical discectomy + bony fusion.

15 patients with radiculopathy underwent anterior cervical discectomy + bony fusion without instrumentation.

6 patients with both radiculo- myelopathy underwent multi level anterior cervical discectomy and bony fusion with stabilization.



1 - Myelopathy 2 - Radiculopathy

Majority of the patient with radiculopathy had grade 0 nuricks score.

Majority of myelopathy patients had grade 3 and 4 nuricks score.

Patients with grade 4 and grade 3 nuricks had better post operative nuricks score of 2 and 1.

Patients with myelopathy predominantly had torgs ratio of <0. 80 and radioculopathy predominantly had between 0.90 – 1.0, which indicates that patients with developmentally stenotic cervical spine are more prone to myelopathy.

In follow up imaging with Xray adjacent level disease was seen in 19 patients including conservatively managed group.

Out of the 11 patient who underwent posterior cervical laminectomy, post op imaging showed development of kyphosis in 2 patients, without any neurological deterioration.

Axial pain seems to be the most annoying post operative feature of patients undergoing posterior cervical laminectomy for myelopathy as evidenced by post operative pain scale in these patients.

Mean pre operative pain score is 2.93 and mean post op pain score is 0.73 calculated with a confidence interval of 95%, which confirms significant reduction in pain thereby depicting a positive correlation between surgery and outcome pre dominantly improvement in pain due myelopathy and radiculopathy.

CONCLUSION

CONCLUSIONS

Correlating the 2 principal complaints [radiculopathy and myelopathy] with the sociodemographic data such as age group, sex, marital status and occupation the following statistical results were obtained.

1. Among the 41 patients treated surgically 25 patients i.e. 61 % presented with myelopathy and 16 patients i.e. 39% presented with radiculopathy.

2. Occurrence of symptoms was high in group 3 i.e. patients in the age group 40-50 years of age. They comprised 36.6 % among the study group.

3. Both myelopathy and radiculopathy showed increased incidence in males patients.

4. Patients occupied as manual laborers presented with myelopathy and radiculopathy than any other occupation.

5. Mean duration of symptoms in radiculopathy < 1 month and for the myelopathy group was between 3 months and 1 year.

6. Patients with radiculopathy had predominantly disc bulge with no additional significant MR findings, whereas patients with myelopathy had multiple compressive elements in MR imaging signifying the multifactorial compression of the cord in myelopathy.

7. MR sagittal diameter of the canal in myelopathy group was < 10mm in the myelopathy group, and between 10-12 mm in the radiculopathy group.

8. Mean pre op NURICK'S score in myelopathy patients was 2.94 and the mean post op NURICK's score was 1.61 in our study. The outcome of the NURICK's score indirectly evaluates the outcome of the surgical treatment.

9. The mean pre op TORG's ratio in the myelopathy group in our study is 0.81, which is less than the mean noted in the western population[0.86] which concludes that developmentally stenotic spine is more prone to myelopathy.

10. In follow up X-ray, adjacent level disease was seen in 19 patients which included the conservatively managed group.

11. The mean pre op pain score is 2.93 and the post op pain score is 0.73. This statistically significant outcome indirectly assesses the surgical outcome with regards to the pain.

12. Axial pain seems to be the most annoying post operative feature of patients undergoing posterior cervical decompressive laminectomy as evidenced by the postoperative pain scale in these patients.

13. Out of the 40 patients managed conservative, none progressed to surgery, but had evidence of progression of Spondylosis in X-ray C-spine Imaging.

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BIBLIOGRAPHY

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ANNEXURES

APPENDIX

PROFORMA

NAME : **AGE** **IP NO :**

Address & Phone No.

Occupation:

Date of admission:

Date of surgery :

Date of discharge:

Presenting complaints:

1. Neck pain - localized/radiating
2. Numbness/paresthesia
3. Tightness of limbs
4. Bladder/Bowel disturbances
5. Erectile dysfunction/impotency
6. Painful restriction of range of neck movements
7. Weakness of upper limbs.
8. Weakness of lower limbs.

Risk factors :

1. Smoking yes/ no (if yes, duration)
2. Lifting heavy weight yes/no (if yes, duration)
3. Driving yes/no
4. Trauma to axial spine yes/no
5. Sleeping in abnormal posture.
6. Travelling long hours in a 2 wheeler.

FAMILY HISTORY

GENERAL EXAMINATION

- **Height** **Weight** **BMI**
- **Pallor**
- **Hydration**
- **Icterus**
- **Pulse Rate** **BP**

SYSTEMIC EXAMINATION

- **Cardio vascular system**
- **Respiratory system**
- **Abdomen examination**

Neurological examination : Right Left

Upper limb

Bulk
Tone
Power
DTR
Sensory
Hoffmans sign

Lower limb

Bulk
Tone
Power
Sup reflexes
DTR
Sensory
Plantar

Spine deformities yes/ no

Spinal tenderness yes/ no.

Single breath count
Chest expansion.

INVESTIGATIONS

i. **Complete Hemogram**
ii. **Blood Grouping & Typing**
iii. **Renal function tests :**

XRAY C SPINE : AP/ LATERAL VIEWS:

1. **Anterior osteophytes /posterior osteophytes.**
2. **Disc space narrowing**
3. **Loss of lordosis**
4. **Foraminal spurs**

MRI C-SPINE

1. **Canal diameter**
2. **Ligamentum flavum hypertrophy**
3. **OPLL**
4. **Secondary cord changes**
5. **Disc herniation**

DIAGNOSIS

1. **Disc herniation causing radiculopathy**
2. **Disc herniation causing myelopathy**
3. **OPLL**
4. **Ligamentum flavum hypertrophy**
5. **Osteophytes/ sharp spurs**

SURGICAL OPTIONS

1. **Anterior cervical discectomy and bony fusion with autologous bone graft**
2. **Anterior cervical discectomy and CAGE/CSLP stabilization**
3. **Anterior corpectomy and CAGE/ CSLP stabilization**
4. **Posterior cervical decompressive laminectomy**

POST OP CLINICAL EVALUATION:

4-6 MONTHS:

POST OP RADIOLOGICAL EVALUATION:

4-6 MONTHS:

PATIENT CONSENT FORM

STUDY TITLE : **CERVICAL DEGENERATIVE DISEASE – PRESENTATION, RADIOLOGICAL CORRELATION, SURGICAL OPTIONS AND OUTCOME**

"STUDY CENTRE : Department of Neurosurgery,
Stanley Medical College, Chennai- 1
Patient may check (✓) these boxes.

PARTICIPANT NAME : AGE:
I.D.NO. :

I confirm that I have understood the purpose of the above study. I have the opportunity to ask the question and all my questions and doubts have been answered to my complete satisfaction. ☐

I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving any reason, without my legal rights being affected. ☐

I understand that investigator, the institution, regulatory authorities and the ethics committee will not need my permission to look at my health records both in respect to the current study and any further research that may be conducted in relation to it, even if I withdraw from the study. I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ☐

I hereby consent to, undergo complete physical examination, and diagnostic tests including hematological, biochemical, radiological and urine examination ☐

I hereby consent to participate in this study of **CERVICAL DEGENERATIVE DISEASE – PRESENTATION, RADIOLOGICAL CORRELATION, SURGICAL OPTIONS AND OUTCOME.** ☐

Signature of the Patient : ..... Place ..... Date .....

Address .....

Signature of the Witness : ..... Place ..... Date .....

Signature of the Investigator:..... Place ..... Date .....

INSTITUTIONAL ETHICAL COMMITTEE, STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work : Cervical Degenerative Diseases – Clinical presentation, Radiological correlation, Surgical Options and Outcome

Principal Investigator : Dr.S.S. Aravind

Designation : PG in M.Ch (Neuro Surgery)

Department : Department of Neuro Surgery
Government Stanley Medical College,
Chennai-1

The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 11.06.2012 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

1. You should inform the IEC in case of changes in study procedure, site investigator investigation or guide or any other changes.
2. You should not deviate form the area of the work for which you applied for ethical clearance.
3. You should inform the IEC immediately, in case of any adverse events or serious adverse reaction.
4. You should abide to the rules and regulation of the institution(s).
5. You should complete the work within the specified period and if any extension of time is required, you should apply for permission again and do the work.
6. You should submit the summary of the work to the ethical committee on completion of the work.

17/7/12.

MEMBER SECRETARY,
IEC, SMC, CHENNAI

Arvind Ss 18081551 M.C.H. NEURO SURG User Info. Messages

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	Info	Dates			Similarity	
Medical		**Start** **Due** **Post**	21-Nov-2012 31-Mar-2013 01-Apr-2013	11:24AM 11:59PM 12:00AM	21%	Resubmit View
Dental		**Start** **Due** **Post**	27-Nov-2012 31-Dec-2012 07-Jan-2013	12:43PM 11:59PM 12:00AM		Submit View

KEY TO MASTER CHART

AGE:

20 – 30 YEARS : 1

31 – 40 YEARS : 2

41 – 50 YEARS : 3

51 – 60 YEARS : 4

61 – 70 YEARS : 5

SEX :

MALE / FEMALE

OCCUPATION :

UNEMPLOYED (OLDAGE, HOME MAKERS) : 1

LABOURER (DAILY WAGES WORKERS INVOLVED IN HEAVY STRENUOUS ACTIVITIES) : 2

FARMERS : 3

SELF EMPLOYED : 4

BODY MASS INDEX :

1 : <20

2 : 20.5 - 23

3 : 23.5 – 25

4 : 25.5 – 27

5 : 27.5 – 30

6 : >30

COMPLAINTS :

1 : NECK PAIN

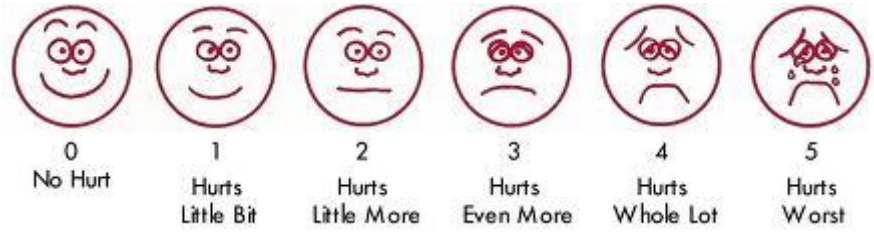
2 : NECK PAIN WITH RADIATING CHARACTER

3 : TIGHTNESS OF LIMBS

4 : BENUMBED SENSATION

5 : BLADDER AND BOWEL DISTURBANCES

PRE OP AND POST OP PAIN : WONG BAKER PAIN SCORE



CLINICAL FINDINGS :

CONSERVATIVE : 0 DENOTES NORMAL POWER, SENSORY FUNCTIONS, DTR AND ABSENT MYELOPATHY

OPERATED PATIENTS:

POWER : 1 (NORMAL)

2 (DECREASED)

SENSORY FUNCTIONS : 1 (NORMAL)

2 (INCREASED)

3 (DECREASED)

MYELOPATHY : 0 (NO)

1 (MYELOPATHY +)

DEEP TENDON REFLEXES: 1 (NORMAL)

2 (INCREASED)

3 (DECREASED)

RISK FACTORS :

1 : LIFTING/CARRYING HEAVY WEIGHT

2 : SLEEPING IN SEATED POSTURE

3 : TRAVELLING LONG DISTANCE IN MOTORCYCLE

4 : NO PHYSICAL EXERCISE

5 : LONG HOURS IN A COMPUTER

6 : OLD AGE

NEUROLOGICAL DEFICIT :

X : NO NEUROLOGICAL DEFICIT

1 : C4

2 : C5

3 : C6

4 : C7

5 : C8

6 : T1

SPASTICITY : S0, S1, S2, S3, S4

X RAY FINDINGS : PRE OP

1 : LOSS OF DISC SPACE

2 : ANTERIOR OSTEOPHYTE

3 : POSTERIOR OSTEOPHYTE

4 : LOSS OF LARDOSIS

X RAY C SPINE POST OP :

1 : DISC SPACE NORMAL

2 : ANT. OSTEOPHYTE/POST OSTEOPHYTE AT OPERATIVE SITE DECREASED

3 : POST OP KYPHOSIS

4 : ADJACENT LEVEL OSTEOPHYTES

MRI C- SPINE :

X : NORMAL

1 : DISC BULGE COMPRISING LEFT ROOT

2 : DISC BULGE COMPRISING RIGHT ROOT

3 : CENTRAL DISC BULGE COMPRESSING CORD AND PRESENCE OF OSTEOPHYTE

4 : 3 + MYELOMALACIA

5 : OSSIFICATION OF POSTERIOR LONGITUDINAL LIGAMENT A – CONTINUOUS

B – SEGMENTAL

C – MIXED

D – LOCALISED

6 : LIGAMENTUM FLAVUM HYPERTROPHY

MR DIMENSION : SAGGITAL (1), TRANSVERSE (2)

S1 : <10

S2 : 10 – 12

S3 : 12 – 14

S4 : >14

RESPONSE TO CONSERVATIVE TREATMENT :

(1 : CONSERVATIVE TREATMENT)

1 : GOOD

2 : BETTER

3 : NO RESPONSE

SURGICAL PROCEDURE :

1 : SMITH ROBINSON TECHNIQUE

2 : MULTIPLE LEVEL ANTERIOR CERVICAL DISCECTOMY + GRAFTING + CERVICAL SPINE LOCKING PLATE

3 : CORPECTOMY + CAGE

4 : POSTERIOR CERVICAL DECOMPRESSIVE LAMINECTOMY

5 : CORPECTOMY + GRAFT

NURICK'S GRADING :

Grade 0 : signs or symptoms of root involvement but without evidence of spinal cord disease

* Grade 1 : signs of spinal cord disease but no difficulty in walking.

* Grade 2 : slight difficulty in walking which does not prevent full-time employment

* Grade 3 : difficulty in walking which prevented full time employment or the ability to do all housework, but which was not so severe as to require someone else's help to walk

* Grade 4 : able to walk only with someone else's help or with the aid of a frame.

* Grade 5 : chairbound or bedridden.

MASTER CHART

S. No	Name	Age group	Sex	Ip no.	Occu-pation	Marital status	Risk factors	Bmi	com-plaints	duration	pre op pain	clinical findings	neuro logical deficit	spine tender ness	torg-pavlov	pre op mri cspine	ct	mr dimen sion	conser vative manage ment	duration	res-ponse	surgical manage ment	nurick's pre op	nurick's post op	post op pain	pre op xray	post op xray
1	Duraisamy	4	male	30406	2	married	1	2	2	6 months	4	p2, s3, m0,d3	left, 1, 2	0	0.96	1	0	s1	0	0	0	1	0	0	0	1, 4	1
2	Sundaramurthy	1	male	30213	4	single	5	1	2	4 months	4	p2, s3, m0,d3	right,1,2	0	0.86	2	0	s1	0	0	0	1	0	0	1	2,3	1,4
3	Dakshinamoorthy	5	male	31021	1	married	4,6	5	1,2,4	1 month	3	p2,s3,m1,d2	s3	1	0.72	5a	1	s1	0	0	0	4	4	3	1	3	3
4	Janakiraman	3	male	31045	3	married	1	2	1	10 days	2	p1s1m0d1	x	0	1.02	x	0	s4	1	10 days	1	0	0	0	0	4	5
5	Dharani	4	male	37452	2	married	1	1	1	15 days	2	p0s0m0d1	x	0	0.99	x	0	s4	1	2 weeks	1	0	0	0	0	1,4	5
6	Ramalingam	5	male	36884	3	married	4,6	4	1,3,5	3 months	2	p2s3m1d2	s2	0	0.76	3	0	s1	0	0	0	2	2	1	1	1,2,3,4	1
7	Chandraiya	6	male	38600	1	married	1,6	4	1,3,4	2 months	2	p2s3m1d2	s4	0	0.74	3	0	s1	0	0	0	4	1	0	1	3	4
8	Somasundaram	5	male	37130	1	married	1	2	1,2	7 days	5	pos0m0d1	x	1	0.99	x	0	s4	1	12 days	1	0	0	0	1	4	5
9	Murthy	3	male	37362	2	married	1	1	1	10days	2	p0s0m0d1	x	0	1.09	x	0	s4	1	10 days	1	0	0	0	0	4	5
10	Ravichandran	3	male	42291	2	married	1,2	2	1,3,4	2 months	2	p2s3m1d2	s4	0	0.68	5a	1	s1	0	0	0	4	2	1	1	3	4
11	Prem raj	3	male	41411	3	married	1,3	2	2,4	1 month	4	p2s3m1d3	right,2+4,3	0	0.98	2	0	s3	0	0	0	1	0	0	1	1	1,4
12	Srinivasan	3	male	42891	2	married	1	2	3,4	1 month	1	p2s3m1d2	s4	0	0.86	3	0	s1	0	0	0	2	2	1	1	2,3	1,4
13	krishnaveni	3	female	42899	2	married	1	2	1	10 days	1	p0s0m0d1	x	0	0.96	x	0	s4	1	10 days	1	0	0	0	0	4	5
14	chinnaponnu	2	female	43002	2	married	1	2	1,2	7 days	4	p0s0m0d1	x	1	0.99	x	0	s4	1	8 days	1	0	0	0	1	1,2	5
15	vasantha	3	female	3723	2	married	1	2	1,3,4	2 months	3	p2s3m1d2	s4	0	0.82	3	0	s1	0	0	0	2	2	1	1	1,3	1,4
16	ganesh	2	male	9714	4	married	3	3	2	2 months	5	p2s3m0d3	right,2+5, 3	0	0.94	2	0	s2	0	0	0	1	0	0	1	1	1,2
17	chinna venkatayya	3	male	6886	2	married	1,6	2	1,3,4	3 months	3	p2s3m1d2	s2	0	0.71	5a	1	s1	0	0	0	5	5	4	2	3	4
18	rathnasami	5	male	15828	1	married	4,6	5	1,3	3 months	3	p2s1m1d2	s4	0	0.89	3	0	s1	0	0	0	4	2	0	2	2,3	4
19	mannu	5	male	15810	1	married	1,6	4	1	15 days	1	p0s0m0d1	x	0	1.06	x	0	s4	1	10 days	1	0	0	0	1	4	5
20	esakki	6	male	15987	1	married	1,6	4	1,2	15 days	4	p0s0m0d1	x	1	0.98	x	0	s4	1	12 days	1	0	0	0	1	4	5
21	selvam	2	male	39577	2	married	1	2	2	20 days	5	p2s3m0d3	left,5,3	0	0.98	1	0	s2	0	0	0	1	0	0	2	1,3	1,2
22	kodeeswaran	3	male	9428	2	married	1	2	2	1 month	5	p2s3m0d3	right,6,4	0	0.94	2	0	s2	0	0	0	1	0	0	1	1,2,3	1,2
23	selvi	2	female	9876	2	married	1	3	1	15 days	2	p0s0m0d1	x	0	0.99	x	0	s4	1	10 days	1	0	0	0	1	1,2	5
24	murugan	5	male	10087	2	married	1,2,6	4	1	10 days	1	p0s0m0d1	x	0	0.97	x	0	s3	1	14 days	1	0	0	0	0	1,2,4	1
25	nithyanandan	4	male	39877	2	married	1,6	3	2	2 months	5	p2s3m0d3	right,1,2	0	0.82	2	0	s2	0	0	0	1	0	0	1	1,2,3	1,2,4
26	srinivasan	2	male	18247	4	married	3	2	1,3,4	2 months	3	p2s4m1d2	s4	0	0.76	5a	1	s1	0	0	0	4	2	1	1	1,3	1
27	nirmala	4	female	21883	2	married	1	3	1,2	1 month	3	p1s3m0d1	0,3	1	0.99	2	0	s2	0	0	0	1	0	0	0	1,2	1,2
28	raju	2	male	42098	4	married	1,3	3	1	10 days	1	p0s0m0d1	x	0	0.97	x	0	s4	1	10 days	1	0	0	0	0	1,4	5
29	singaram	4	male	42145	2	married	1	2	1,2	10 days	4	p0s0m0d1	x	1	1.05	x	0	s4	1	10 days	1	0	0	0	1	1,2	5
30	ramesh	2	male	42476	4	unmarried	1,3	3	1	14 days	1	p0s0m0d1	x	0	0.98	x	0	s4	1	7 days	1	0	0	0	1	1,2,4	5
31	mathias	5	male	9281	2	married	1,6	3	1,3,4,5	2 months	2	p2s3m1d2	s2	0	0.68	3,5b,6	1	s1	0	0	0	3	4	2	1	1,3	1
32	anbu	3	male	43356	2	married	1	2	1	10 days	1	p0s0m0d1	x	0	0.99	x	0	s4	1	7 days	1	0	0	0	0	1	5
33	rajathi	4	female	43786	2	married	1	4	1	7 days	1	p0s0m0d1	x	0	1.03	x	0	s4	1	7 days	1	0	0	0	0	1,2	4
34	asaithambi	3	male	16589	2	married	1	3	1,3,4	2 months	1	p2s3m1d2	s3	0	0.72	5d	1	s1	0	0	0	3	3	1	1	1,3	1,2,4
35	ezhumalai	3	male	43900	2	married	1	4	1	12 days	2	p0s0m0d1	x	0	1.07	x	0	s4	1	14 days	1	0	0	0	0	1	4
36	chandrammal	3	male	19757	2	married	1	3	1	3 months	2	p1s3m0d1	right,1,2	0	0.84	2	0	s2	0	0	0	1	0	0	0	1,2	1,2
37	shankar	5	male	30871	1	married	4,6	5	1	3 months	1	p2s3m0d1	left,6,4	0	0.89	1	0	s2	0	0	0	1	0	0	0	1,4	1,4
38	radhakrishnan	6	male	6348	1	married	4,6	5	1,3,4,5	4 months	2	p2s3mod2	s2	0	0.7	5d,6	1	s1	0	0	0	3	3	1	1	2,3	2
39	jansi	2	female	44265	2	married	1,2	4	1	10 days	1	p0s0m0d1	x	0	0.96	x	0	s4	1	10 days	1	0	0	0	0	1,2	5
40	gaja	5	male	44876	2	married	1	3	1	10 days	2	p0s0m0d1	x	0	1.06	x	0	s4	1	9 days	1	0	0	0	1	1	5
41	ethiraj	1	male	17016	4	unmarried	1,3	3	1,3,4	3 months	2	p2s1m1d2	s3	0	0.78	3	0	s1	0	0	0	3	4	2	1	1,3	4
42	thiagaraj	4		17775	1	married	4,6	5	1,3,4	1 month	2	p2s3m1d2	s4	0	0.86	5b	1	s1	0	0	0	3	3	2	0	1,2,3	1
43	ramu	3	male	45871	2	married	1	3	1	10 days	1	p0s0m0d1	x	0	0.99	x	0	s4	1	10 days	1	0	0	0	0	1,4	5
44	karthikeyan	4	male	45908	2	married	1	2	1	14 days	2	p0s0m0d1	x	0	0.94	x	0	s4	1	10 days	1	0	0	0	1	1,2	5
45	srinivasan	2	male	27579	4	married	1,3	3	1	2 months	2	p1s3m0d3	right,0,1+2	0	0.91	2	0	s2	0	0	0	2	0	0	0	2	2
46	seenu	2	male	43671	4	married	1,3,5	4	1	12 days	2	p0s0m0d1	x	0	0.99	x	0	s4	1	7 days	1	0	0	0	0	1,2	4
47	krishnan	5	male	28054	1	married	1,4,6	4	2	1 month	5	p2s3m0d3	left,3,3	0	0.89	1	0	s2	0	0	0	1	0	0	1	2	1,2
48	baskar	3	male	34987	3	married	1,2	3	1,2	5 days	4	p0s0m0d1	x	1	1.05	x	0	s4	1	10 days	1	0	0	0	1	1,2,4	5
49	shankar	2	male	39842	3	married	1	3	1	10 days	2	p0s0m0d1	x	0	1.09	x	0	s4	1	10 days	1	0	0	0	1	1,2	4
50	ravi	2	male	47652	4	unmarried	1,3	2	1	10 days	1	p0s0m0d1	x	0	1.05	x	0	s4	1	7 days	1	0	0	0	0	1,2	5
51	gowri	3	female	43098	2	married	1	2	1	8 days	2	p0s0m0d1	x	0	0.94	x	0	s4	1	10 days	1	0	0	0	0	1,4	5
52	murugan	2	male	2120	2	married	1,4	3	1,3	2 months	1	p2s1m1d2	s4	0	0.83	3,6	0	s1	0	0	0	4	3	1	1	2	3
53	kasi	3	male	12714	2	married	1,4	3	2	2 months	4	p2s1m0d1	left,0,1	0	0.91	1	0	s1	0	0	0	1	0	0	0	3	1,2
54	aravi	4	female	15841	2	married	4,6	3	1,3,4	3 months	3	p2s3m1d2	s3	0	0.78	3,5	1	s1	0	0	0	4	4	3	1	1	4
55	saravanan	3	male	45987	3	married	1,2	3	1	14 days	1	p0s0m0d1	x	0	1.02	x	0	s4	1	7 days	1	0	0	0	0	1	5
56	kumar	3	male	37697	2	married	1,2	2	1	10 days	2	p0s0m0d1	x	0	1	x	0	s4	1	10 days	1	0	0	0	0	1,2	4

S. No	Name	Age group	Sex	Ip no.	Occu-pation	Marital status	Risk factors	Bmi	com-plaints	duration	pre op pain	clinical findings	neuro logical deficit	spine tender ness	torg-pavlov	pre op mri cspine	ct	mr dimen sion	conser vative manage ment	duration	res-ponse	surgical manage ment	nurick's pre op	nurick's post op	post op pain	pre op xray	post op xray
57	kumarasamy	4	male	26993	2	married	1	4	1,3	2 months	2	p2s3m1d2	s4	0	0.82	5a	1	s1	0	0	0	4	4	3	1	2	1,2
58	ponmathi	3	female	37864	2	married	1,2	2	1	10 days	2	p0s0m0d1	x	0	0.93	x	0	s4	1	10 days	1	0	0	0	0	1,2,4	5
59	suseela	4	female	36458	1	married	1,2,4	3	1,2	7 days	5	p0s0m0d1	x	1	1.08	x	0	s4	1	7 days	1	0	0	0	1	1,2	5
60	venkatesan	3	male	34668	2	married	1	2	1,3,4	2 months	2	p2s3m1d1	s4	0	0.8	5c	1	s1	0	0	0	4	3	2	1	3	1,2
61	jayaraman	3	male	16457	4	married	1	2	1,3,4	2 months	2	p2s3m1d2	s4	0	0.81	3,5a	1	s1	0	0	0	4	4	2	1	1,2,3	2
62	natarajan	3	male	22721	4	married	1	1	2	1 month	4	p1s3mod1	right,0,3	0	0.91	2	0	s2	0	0	0	1	0	0	0	1,2	5
63	munusamy	3	male	37415	3	married	1	3	1,3,4	7 months	2	p2s3m1d2	s3	0	0.78	3	0	s1	0	0	0	3	3	2	0	2,3,4	2
64	karuna	2	male	20076	4	married	3,4	4	1,4	12 days	1	p0s0m0d1	x	0	0.97	x	0	s4	1	1	1	0	0	0	1	1,2	5
65	elavan	3	male	36652	3	married	1,3	2	1	10 days	2	p0s0m0d1	x	0	0.96	x	0	s4	1	1	1	0	0	0	1	1,4	5
66	raajeev	3	female	42106	4	married	1	3	2	4 months	4	p2s3m0d3	left,5,3	0	0.92	1	0	s3	0	0	0	1	0	0	0	1,2	1,2
67	dayalan	5	female	21734	1	married	1,6	2	1,3,4,5	8 months	2	p2s3m1d2	s2	0	0.71	5b	1	s1	0	0	0	3	5	4	0	1,2,3,4	2
68	sampath	1	male	35627	2	unmarried	1,2	3	1,4	10 days	1	p0s0m0d1	x	0	1.08	1	0	s4	1	1	1	0	0	0	1	1,2,4	5
69	rani	3	female	30087	2	married	1,2	3	1	10 days	2	p0s0m0d1	x	0	1.05	2	0	s4	1	1	1	0	0	0	0	1,2	5
70	sarathi	3	male	28610	3	married	1	2	1	15 days	1	p0s0m0d1	x	0	1.09	x	0	s4	1	1	1	0	0	0	0	1	5
71	sivakumar	2	male	15179	4	married	1,5	3	2	1 month	4	p1s3m0d3	right,0,3	0	0.98	2	0	s2	0	0	0	1	0	0	0	1,2	1,2
72	muthiah	4	male	27602	2	married	1	3	1,3	10 days	1	p0s0m0d1	x	0	0.99	6	0	s4	1	1	1	0	0	0	1	1,4	5
73	choolai	3	male	29980	2	married	1	3	1,2	8 days	5	p0s0m0d1	x	1	1.09	x	0	s3	1	1	1	0	0	0	0	1,2	4
74	shanti	4	female	26629	2	married	1,6	3	1	12 days	2	p0s0m0d1	x	0	1.08	x	0	s4	1	1	1	0	0	0	0	4	5
75	poongkodi	3	female	27925	2	married	1,2,6	2	2	20 days	4	p1s3mod1	right,0,1	0	0.92	2	0	s3	0	0	0	1	0	0	1	1,2	1,2
76	gopal	6	male	30065	1	married	4,6	5	1,4	15 days	1	p0s0m0d1	x	0	0.97	2	0	s4	1	1	1	0	0	0	1	2,4	5
77	malar	5	female	44211	1	married	1,2,3,6	4	1,3,4	8 months	2	p2s3m1d2	s3	0	0.75	4,6	0	s1	0	0	0	4	3	2	1	1,2,3	2
78	avvai	4	female	1009	4	married	1	2	1	10 days	2	p0s0m0d1	x	0	0.99	x	0	s4	1	1	1	0	0	0	0	1,2	5
79	pushpavalli	2	female	15841	4	married	1	3	1,2,3,4	2 months	4	p2s3m1d2d3	left,3,4,6,3,4,s4	1	0.82	1,3	0	s2	0	0	0	2	4	1	0	1,2,4	1
80	subbramani	4	male	167	2	married	2	1	1,2,3,4	4 months	5	p2s3m1d2d3	right,5,6,3,4,s4	1	0.82	2,3	0	s2	0	0	0	2	4	1	0	1,2,4	1,2